Manual for the Management of Wastes Containing Polychlorinated Biphenyls (PCBs)

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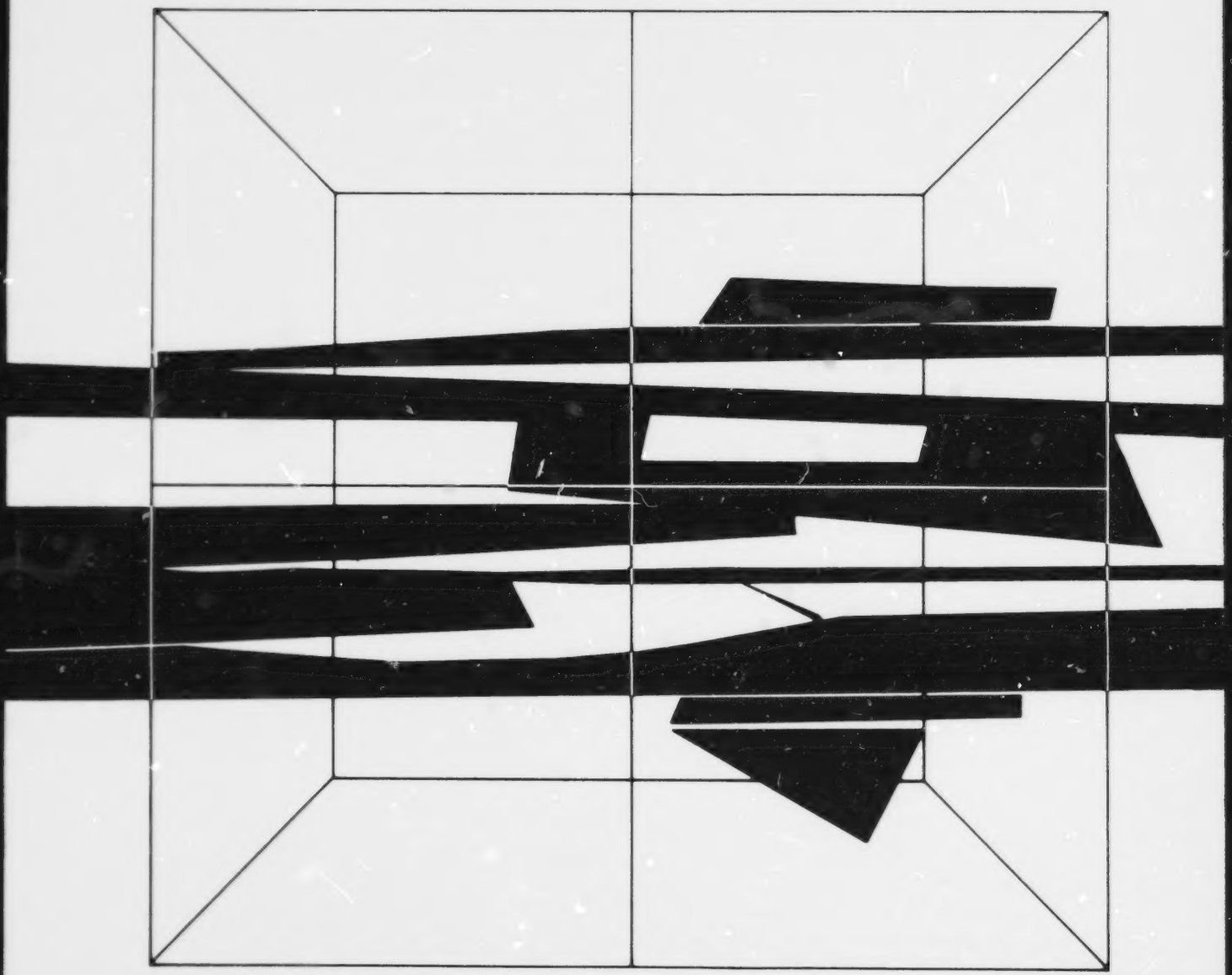

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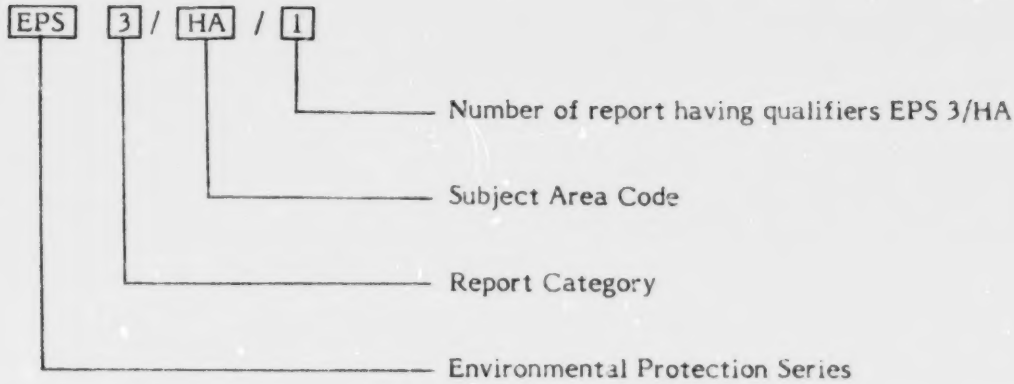

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MANUAL FOR THE MANAGEMENT OF WASTES CONTAINING POLYCHLORINATED BIPHENYLS (PCBs)

Industrial Programs Branch
Environmental Protection
Conservation and Protection
Environment Canada

based on report to the
Industrial Programs Branch
by

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Toronto, Ontario
(May 1985)

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ABSTRACT

This manual presents recommended practices for the management of wastes containing polychlorinated biphenyls (PCBs). It covers procedures for decommissioning and decontamination, storage, transportation, disposal, labelling and recordkeeping, and emergency preparedness for PCB-contaminated equipment and containers, as well as for solid and liquid wastes containing more than 50 ppm of PCBs.

RÉSUMÉ

Le présent manuel recommande les procédures à suivre pour la gestion des déchets contenant les biphényles polychlorés (BPC); il porte sur la mise hors service et la décontamination, l'entreposage, le transport, l'élimination, l'étiquetage, la tenue de registres, l'état de préparation et les procédures d'urgences pour l'équipement et les conteneurs contaminés par les BPC, ainsi que pour les déchets solides et liquides contenant plus que 50 ppm de BPC.

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Many people were involved in the development of this manual, which is based on a report prepared for Environment Canada by M.M. Dillon Limited. The project was supervised by an Environment Canada committee consisting of A. Burgess, H. Dibbs and J. Armstrong. Significant contributions were provided by members of the Waste Committee of the Canadian Council of Resource and Environment Ministers as well as by Environment Canada's headquarters staff and by staff in Environment Canada's regional offices. In addition, comments and suggestions from the Occupational Safety and Health Branch of Labour Canada, and from the Environmental Health Directorate of Health and Welfare Canada were incorporated in the manual.

Special acknowledgements are also due to electric utility companies and industrial associations for reviewing drafts of this manual and providing comments, recommendations, and background information.

1 INTRODUCTION

1.1 Purpose

The purpose of this manual is to present recommended practices for the management of wastes containing polychlorinated biphenyls (PCBs). It is intended for the guidance of PCB waste generators in the industrial and commercial sectors and the federal government and for provincial authorities in developing their own guidelines and regulations. With the exception of the specific federal responsibilities described below (Section 1.2), the recommendations of this manual are not enforceable by law because the legal responsibility for the management of hazardous wastes, including PCBs, falls mainly under provincial jurisdictions. The provinces may impose more stringent requirements than those recommended here. Users should consult with the appropriate authorities for site-specific requirements.

This manual is not intended to address all aspects of PCB waste management but rather to provide basic recommendations and practices (particularly for those wastes containing more than 50 ppm of PCBs) in order to promote good management of PCB wastes in a consistent manner across Canada.

To a large extent, the effectiveness of the regulations under the Environmental Contaminants Act restricting the use of PCBs depends on the adoption and implementation of effective PCB waste management practices. To assist in developing these practices and in response to a request for coordination from the provincial environment departments, Environment Canada undertook to develop this manual. The manual deals with solid and liquid PCB wastes and addresses the decommissioning, storage, transportation and disposal of PCB-contaminated equipment and containers, the labelling of PCB wastes for record keeping at storage and disposal facilities, and emergency procedures for spills or fires involving PCBs.

1.2 Federal Legislative Mandate

The federal government has responsibility for wastes within federal facilities and has specific responsibilities for the management of PCBs in accordance with the mandate prescribed by the following federal legislation:

- Environmental Contaminants Act;
- Fisheries Act;
- Ocean Dumping Control Act; and
- Transportation of Dangerous Goods Act.

The following are the main PCB prohibitions covered by regulations under the Environmental Contaminants Act:

Chlorobiphenyl Regulations, No. 1, Amendment (1)

prohibit the use of PCBs except in a few applications, mainly electrical transformers and capacitors that existed in Canada before July 1, 1980, and heat transfer equipment, hydraulic equipment, electromagnets and vapour diffusion pumps that were designed to use PCBs and were in use in Canada before September 1, 1977. They also prohibit the use of PCBs as new filling or as make-up fluid in the servicing or maintenance of electro-magnets or electrical transformers and associated electrical equipment.

Chlorobiphenyl Regulations No. 2 (Product) (2)

prescribe the maximum concentration of PCBs (50 ppm) that electrical and mechanical equipment, that was designed to use PCBs, may contain when imported, manufactured or offered for sale.

Chlorobiphenyl Regulations No. 3 (Release) (3)

prescribe the maximum concentrations and quantity of PCBs that may be willfully released into the environment in the course of a commercial, manufacturing or processing activity. This regulation applies to the operation, servicing, maintenance, decommissioning, transportation or storage of PCB equipment.

For a more detailed description of these three regulations see Appendix A or contact the Commercial Chemicals Branch of Environment Canada (see Appendix F).

The Fisheries Act, Subsection 33(2) prohibits the deposition of deleterious substances into waters frequented by fish except as may be permitted by regulations. This Act applies to waters frequented by fish or waters leading to fish-frequented waters and takes precedence over Regulation No. 3 above.

The Ocean Dumping Control Act governs the disposal of PCBs at sea, including incineration, through permits and regulations which specify environmental operating requirements.

Regulations under the Transportation of Dangerous Goods Act (TDGA) govern the transportation of equipment and wastes containing PCBs (see regulations and procedures described in Chapter 5). In this manual, these regulations are referred to as the Transportation of Dangerous Goods (TDG) Regulations.

1.3 PCB Waste Definition

For the purpose of this manual, PCB wastes are defined as any PCB-contaminated liquid, solid, equipment or packaging for which the owner has no further use. Only those wastes containing greater than 50 ppm PCBs are addressed (with the exception of the few instances where current federal or provincial regulations specify lower permissible concentrations).

This limit of 50 ppm does not mean that wastes with lower PCB concentrations may not in some instances be of concern, for example, wastes released to an environmentally-sensitive area. It is recommended that provincial authorities be contacted for advice on disposal of wastes in this category on a case-by-case basis.

The following specific definitions are pertinent:

PCBs — Chlorobiphenyls that have the molecular formula $C_{12}H_{10-n}Cl_n$, where n is greater than 2. (In Ontario, the definition includes all chlorobiphenyls, $n \geq 1$. All other provinces adhere to the federal definition).

Askarel — A generic name for synthetic electrical insulating materials which, when decomposed by an electric arc, evolve only non-explosive gases or gaseous mixtures. Mixtures containing PCBs and chlorinated benzenes are the most common examples of askarels. For the purpose of this manual "askarel" means mixtures containing PCBs in excess of 30% by weight.

PCB waste — Any PCB liquid, PCB solid, PCB equipment or PCB packaging for which the owner has no further use.

PCB equipment — Any manufactured item, other than PCB packaging, which contains PCB liquids or PCB solids and whose surfaces have been in direct contact with PCBs. Examples of PCB equipment include transformers, capacitors, heat transfer systems, vapour diffusion pumps, electromagnets and hydraulic systems.

PCB-contaminated Oil — Oil containing low concentrations of PCBs, e.g., transformer mineral oil contaminated with PCBs.

PCB liquid — Any liquid containing more than 50 ppm by weight of PCBs.

PCB packaging Any receptacle or enveloping material used to contain or protect PCB wastes.

PCB solid Any substance other than a PCB liquid, PCB equipment or PCB packaging that contains more than 50 ppm by weight of PCBs.

Appendix B provides descriptions of common types of PCB wastes. A list of procedures for the analysis of PCBs in various matrices is given in Analytical Chemistry of PCBs by Mitchell D. Erikson, Butterworth Publishers, 1986. For lists of commercial laboratories capable of analyzing PCBs in various matrices contact federal or provincial environment office (see Appendix F). Detailed information on chemical and physical properties, fire properties, human health and environmental toxicities are given in reference (4).

1.4 Availability of Storage and Destruction Facilities

At present, in Canada, there are no commercial storage facilities for any type of PCB waste; the only storage option available for the owners of such waste is secure storage at the owner's site. Similarly, the only PCB destruction processes available in Canada are chemical processes for the decontamination of PCB-contaminated oil; the operation of these processes has been licensed by several provinces. Development of PCB destruction facilities (high-temperature incineration) for all types of PCB wastes is currently actively underway in three provinces, with the first facility expected to be in operation in late 1987.

2 DECOMMISSIONING AND DECONTAMINATION

2.1 General

When PCB equipment becomes redundant, fails or is retrofilled, it must be carefully removed from service (decommissioned). Part of this process may be the draining and/or decontamination of the equipment to ensure that mechanical components and the contained PCB liquids can be safely stored, transported or disposed of in an acceptable manner.

2.2 Decommissioning

2.2.1 Purpose of Decommissioning. PCB equipment may be removed from service for a number of reasons, including:

- transfer for re-installation at another location;
- transfer to safe storage;
- disposal; and
- retrofilling for re-use (primarily equipment with low-level PCB contamination).

Depending on a number of factors, such as the degree of contamination, size of equipment, transportation regulations, and disposal methods, draining and/or decontamination can take place at the point of removal from service, at some other location prior to transportation, or at the disposal site. Similarly, retrofilling could be accomplished with the equipment remaining in place, or at another location.

2.2.2 Notification and Approval. Notification and approval procedures required by provincial authorities should be followed when decommissioning involves generation of PCB wastes. Regulatory requirements for the handling, storage and disposal of PCB equipment vary from province to province and it is therefore necessary to become thoroughly acquainted with all applicable provincial regulations prior to decommissioning of equipment. A brief summary of provincial regulations applicable to PCB waste management is given in Appendix E. It is also necessary to comply with the federal Chlorobiphenyl Regulations No. 3 (Release) during decommissioning, handling and storage procedures.

When transport of PCB-containing equipment or wastes away from the site is intended, the Transport of Dangerous Goods Regulations must be observed. The requirements of these regulations are described in Chapter 5 of this manual.

2.2.3 Planning and Mobilization. After reviewing all requirements, the next tasks are the preparation of a detailed plan of action and the mobilization of the necessary human and material resources to implement the plan in a safe and efficient manner.

All persons assigned to handle PCB equipment should be thoroughly instructed in the proposed procedures, particularly with respect to safety precautions, the use of safety equipment and the applicability of federal and provincial regulations.

The area where decommissioning will take place must be carefully examined with respect to containment of potential PCB spills, ventilation and working space available. All necessary safeguards should be taken to prevent the escape of PCB waste to adjacent areas.

The type and condition of the PCB equipment and the volume of PCB liquid involved in each case will dictate the extent of precautionary measures to be taken to ensure containment of PCB spills and to facilitate clean-up operations. The willful release to the environment of PCBs from any one piece of equipment during maintenance, decommissioning, or storage must be limited to 1 gram per day (3).

Where transformers are located in separate equipment rooms or vaults the Canadian Electrical Code requires that the rooms be equipped with either a gravity or a forced air ventilation system having direct exhaust to, and air intake from, the outside. These rooms should also have ample ventilation and holding capacity in accordance with design criteria given in Section 3.2.2. Before proceeding with the decommissioning of equipment, the performance of the ventilation system (for enclosed areas) and the integrity of the liquid containment system should be checked and an, deficiencies rectified.

Transformers, capacitors or other PCB equipment located in open manufacturing areas, or other locations with uncontrolled access, present additional problems. Suitable curbs, barriers and/or metal pans should be provided to prevent the escape of PCBs in case of spills during handling operations. Also, floor drains should be plugged and air ducts leading to other parts of the building should be closed.

The extent of other preparatory work depends on the condition of the equipment involved. Prior to movement, liquids should be removed from equipment where cracks or leaks are apparent. Any leaked fluid should be cleaned-up immediately using sorbent materials listed in Chapter 7.

The area of work should be appropriately identified and unauthorized persons prohibited from entering the area.

2.2.4 Protective Clothing and Apparatus. Routine precautions should be observed while handling liquids containing PCBs. The protective clothing to be worn will vary with individual circumstances, such as concentration, quantity of PCBs and whether in solid or liquid form. Where workers may come in direct contact with askarel, protective clothing impervious to PCBs should be worn. Gloves, boots, disposable coveralls, bib-type aprons, and eye protection (face shields or chemical safety goggles) should be worn as necessary. Materials used to protect against dermal exposure to PCBs are compared in Table 1.

TABLE 1 MATERIALS USED FOR PROTECTION FROM DERMAL EXPOSURE TO UNDILUTED PCBs (5)

Highly Recommended (provides protection for over one hour)	Recommended (provides protection for one hour)	Limited use or Not Recommended (provides protection for less than one hour)
Butyl Rubber		
Neoprene	Chlorinated Polyethylene	Styrene Butadiene Rubber
Nitrile Rubber		Natural Rubber
Polyvinyl Alcohol		
Viton		
Saranex		
Teflon		

Where PCBs are in closed containers such as capacitors, transformers, tanks or drums, or are entrapped in solid substances or equipment, and there is no direct contact with PCBs, special clothing and apparatus may not be necessary, e.g., if a lift-truck operator is moving a drum or a palleted piece of PCB equipment.

As a general rule the handling of hot liquids should be avoided. If the temperature of the liquid is above 55°C, a full face self-contained breathing apparatus should be worn for other than brief periods of exposure.

Federal and provincial regulations pertaining to the wearing of protective clothing and equipment must be observed at all times. For additional guidance on personnel protection refer to references (4, 5 and 6).

2.2.5 Decommissioning Procedures. Electrical equipment to be decommissioned should first be disconnected from the power supply by qualified personnel.

Record keeping: Before removal of any decommissioned equipment, a complete record of the equipment should be made, including nameplate data, serial numbers, dates of decommissioning and shipment, destination of equipment, and names of decommissioning personnel, as well as the Environment Canada label identification number, where applicable.

Capacitors: Sealed capacitors should be placed into 200-litre (L), No. 18-gauge steel drums fitted with removeable steel lids and gaskets made of PCB-resistant material, such as nitrile rubber, cork or Teflon. Other leakproof containers providing protection equivalent to that of steel drums and meeting Transportation of Dangerous Goods Regulations and provincial requirements may be used for storing or transporting capacitors. Capacitors should be stored with the terminals up to prevent leakage from the capacitor bushings. As many capacitors as space allows may be placed in each drum.

Leaking capacitors should be drained, then placed in individual heavy duty polyethylene bags before storing in drums. These drums should be packed with sawdust or other sorbent material to absorb PCBs which may escape from the bags.

Drums should be sealed and labelled as described in Chapter 4. They are now ready for storage or transportation.

Non-leaking capacitors that are too large to fit into a 200-L drum should be wrapped in heavy gauge polyethylene and crated for transfer to the storage area. Leaking capacitors should be drained and stored over drip pans containing sufficient absorbent to absorb any remaining liquid. The requirements for off-site transportation are described in Chapter 5.

Transformers: Small transformers may be stored or transported in leakproof containers, without draining, in a manner similar to that for capacitors.

For on-site storage, transformers need not be drained providing they are structurally sound and all cooling tubes, valves and gauges are sealed and protected from damage, and spill containment is provided as described in Chapter 3.

Where large askarel transformers are being stored pending transportation or disposal, the askarel should be removed and stored in double-bung steel drums. The requirements for transportation of PCB transformers are described in Chapter 5.

PCB-contaminated mineral oil may be stored in tanks rather than drums providing the tanks are above ground and are sound, properly labelled, regularly inspected, and spill containment is provided.

Wherever possible, PCB liquids should be transferred by pumping, rather than pouring, to minimize splashing and spillage. Centrifugal-type pumps, having all wetted surfaces made of stainless steel, should be used. The shaft seal should be an external carbon ring type to eliminate exposure of the packing material to the deteriorating effects of PCBs. Valves should be brass or stainless-steel lined. Hoses should be flexible metal or lined with tetrafluoroethylene or silicone polymers, and drip trays should be placed under all pumps, valves and hose couplings.

Other equipment: PCB equipment such as hydraulic equipment, electromagnets, vapour diffusion pumps and heat transfer equipment should be removed from service only by qualified personnel. Care must be taken to prevent loss of liquid during this operation.

Pending ultimate disposal, the drained equipment should be put into storage in drums or wrapped in polyethelene, similar to the procedure for capacitors. Alternatively, the equipment could be appropriately decontaminated (Section 2.3) for re-use or metal recovery. Transportation requirements are described in Chapter 5.

2.2.6 Site Clean-up. Equipment removal should be followed by a thorough clean-up of the site. In general, the clean-up will include:

- absorbing spills (see Chapter 7 for procedures and applicable sorbents);
- wiping the affected area with solvents and rags; and
- placing all contaminated materials in steel drums for disposal.

Tools, pumps and equipment used in decommissioning and site clean-up should be dedicated to the handling of PCBs and labelled as such and thoroughly decontaminated at the completion of each clean-up project.

2.3 Decontamination

Decontamination is a process whereby PCBs are removed from equipment, mineral oil or other materials. Equipment (such as a transformer) is usually decontaminated to meet provincial requirements for disposal in an environmentally safe manner, or to allow it to be used or sold as a non-PCB unit. Decontaminated mineral oil can be recycled, sold or disposed of. PCB handling equipment, such as containers, pumps, hoses, is decontaminated so that it can be re-used for handling other materials, or disposed of.

2.3.1 Decontamination by Solvent Extraction.

Equipment: Decontamination procedures vary considerably depending upon the degree of contamination of the equipment and the purpose for which it is being decontaminated, e.g., for a given end purpose, equipment containing askarels will require more sophisticated procedures than equipment containing contaminated mineral oil.

Askarel equipment: For disposal of askarel transformers in secure landfills in the U.S., the Environmental Protection Agency (EPA) requires decontamination as follows (7): After draining the askarel from the transformer, the transformer is filled with a solvent, such as Varsol, kerosene, turpentine, No. 1 fuel oil, trichlorobenzene or 1,1,1-trichloroethane, and allowed to stand for at least 18 hours before being drained. This refilling procedure is repeated three times using a clean solvent each time. The hulk is then ready for disposal in a secure landfill. Although this method could be considered for use in Canada, no landfills in Canada at this time are accepting decontaminated askarel transformer hulks.

Askarel transformers, as well as capacitors, also can be decontaminated for metal recovery. One company in the U.S. (8,9) has developed a process which has proven to be economically viable on a large scale and has been recently approved by the U.S. EPA (7). In addition to initial rinsing procedures, the equipment is dismantled to permit the individual decontamination of the metal hulk, core and windings, so that the metal can be recovered for sale. Although scrapping for metal recovery is considered the most environmentally acceptable method of disposing of electrical equipment hulks, the sophisticated methods required for decontamination of askarels are not yet available in Canada. In the absence of incinerator facilities in Canada, the only alternative for askarel transformer hulks and capacitors currently is to store them.

For non-electrical askarel-filled equipment, decontamination by triple rinsing is considered suitable for metal recovery.

Contaminated mineral oil equipment: After draining, equipment (including transformers) that contained mineral oil contaminated with PCBs in concentrations less than 500 ppm may be refilled with clean oil for reuse or scrapped for metal recovery. Scrapping is considered acceptable where all free liquid is removed from the hulk, the quantity of PCBs remaining in the core assembly are estimated to be less than 0.005% of the weight of the core assembly, and the scrapping operations meet all appropriate federal and provincial health and environmental standards. The drained oil must be treated as a PCB liquid waste.

Containers: Askarel-contaminated containers, such as drums or tanks, should be decontaminated by triple rinsing with an appropriate solvent (see Chapter 7). The container should be filled with enough solvent to coat the sides of the container when it is tipped and rotated. A solvent volume of approximately 10% of the total container volume has been found to be a useful amount for this rinsing procedure, but a smaller volume may be sufficient as long as there is enough solvent to coat all surfaces of the container. The bottom and sides of the container should be thoroughly rinsed with the solvent and then drained. When containers are too large, or of a design that cannot be tipped and rotated, a method equivalent to rinsing should be used, e.g., the use of a mop or a pressure nozzle.

Containers that held PCB-contaminated mineral oil or solvent should be rinsed in a manner appropriate to the degree of contamination and the intended use of the empty container or to the disposal method.

Solvent Disposal: Solvents used for PCB decontamination should be disposed of as PCB waste when they contain more than 50 ppm (by weight) of PCBs. If, however, several PCB articles are being decontaminated, it is acceptable to use rinse solvent contaminated with greater than 50 ppm PCB as the first rinse where this will reduce the amount of PCB-contaminated liquid ultimately produced (i.e., when the article being rinsed in more highly contaminated).

2.3.2 Retrofilling.

General: Retrofilling involves the removal of PCBs from a piece of equipment followed by their replacement with an alternative non-PCB fluid (10). The purpose of this process is to permit the reclassification of the piece of equipment as a non-PCB unit (i.e., one containing liquid with PCBs < 50 ppm) either for safety reasons, such as when the equipment is located in a food processing plant, or for sale (2).

Retrofill procedures: All retrofill procedures involve similar techniques regardless of the equipment that is being retrofilled. The equipment is drained, decontaminated (Section 2.3.1), and refilled with an appropriate replacement fluid. The amount of decontamination and chemical analysis required will vary with the type of equipment, the degree of contamination and the purpose of decontamination.

PCB-contaminated mineral oil equipment: This equipment (including transformers) can usually be decontaminated to the required level simply by replacement of the oil. Where the mineral oil is highly contaminated, e.g., where a transformer oil contains PCBs at 2000 ppm or more, two or more changes (or rinsings) will be required to reduce

the level of contamination to below 50 ppm. When transformers are refilled it will be necessary to operate for several weeks to establish equilibrium before draining a second time.

Another method of decontamination that is being increasingly used is an "in situ" process where the decontamination unit is connected directly to the transformer and the oil is continuously recycled through the unit until the PCB concentration of the oil has been reduced to acceptable limits.

Askarel equipment (other than electrical): The triple rinsing process described in Section 2.3.1, prior to retrofilling with a non-PCB fluid, is recommended for this type of equipment.

Askarel electrical equipment: Retrofilling of askarel transformers is a sophisticated procedure and should only be done by trained personnel. The success of retrofilling such transformers is highly dependent on the internal design of the transformer case and core, the electrical operating conditions, and the experience of personnel carrying out the procedure. Although very little data are available on the success of retrofilling askarel transformers, companies in the U.S., e.g., Unison Inc. and Acurex Corporation, have guaranteed that it can be done to required standards. It should be noted that, after retrofilling, the power ratings of transformers usually have to be downgraded due to the lower heat transmission characteristics of the replacement fluid (Table 2). In some cases, due to the complexity of a transformer's configuration, it may not be technically and economically feasible to remove PCBs to below the 50 ppm level (11).

TABLE 2 PROPERTIES AND COSTS OF REPLACEMENT FLUIDS FOR PCBs

Properties	PCB Replacement Fluid					
	Silicone Fluid	Aliphatic Hydrocarbons	Chlorinated Benzenes	Poly-α -olefins	Formel NF*	SF_6**
Minimum dielectric strength (kV)	35	44	32	40	40	2.4 (relative to nitrogen = 1)
Thermal conductivity (W/(m • °C) @25°C)	15.1 x 10^{-2}	13 to 13.4 x 10^{-2}	6.7 x 10^{-2}		13 x 10^{-2}	14 x 10^{-2}
Specific heat (kJ/(kg • °C) @25°C)	1.53	1.93	1.59	2.09	0.88	0.67
Viscosity (cm^2/s) at:						
-40°C	3.0					
-17.8°C	1.50					
20°C				83.0		0.305
25°C	0.50		0.034			
50°C		3.5	0.025		0.884	
100°C	0.16	0.85				
150°C	0.1	0.15	0.008	-0.13		
Pour point (°C)	-55	-30	-30	-48	-35	
Specific gravity at						
15.6°C						
20°C				0.86		
25°C	0.960	0.877	1.39		1.62	5
Thermal coefficient of expansion ($cm^3/cm^3/°C$)	10.4 x 10^{-4}	7.5 to 8.5 x 10^{-4}	8 x 10^{-4}	4 x 10^{-4}	10.2 x 10^{-4}	-
Fire point (°C)	365	310 to 312	none to 210°C(b.p.)	315 to 321	none	-
Rate of heat release (kW/m^2)						
- convective	53 to 66	538 to 546	370	564	-	-
- radiant	25 to 26	361 to 441	238	414		
Cost ($/L, July, 1985)	7.23	4.70	3.12	4.46	-	-

* Formel is a blend of four halocarbons, with significant proportions of tetrachloroethylene, trichlorotrifluoroethane, tetrachlorodifluoroethane, and dichlorotetrafluoroethane.

** Sulphur hexafluoride (in the form of liquefied gas).

3 STORAGE

3.1 General

Since there are currently no PCB disposal facilities in Canada, storage of PCB wastes is the only alternative. The siting, construction and operation of a PCB storage facility should comply with all federal and provincial environmental, occupational health and safety requirements, as well as with any applicable municipal by-laws and codes. Transfer of PCB equipment or waste to secure storage should take place as soon as possible after equipment is removed from service or a PCB waste is generated.

Between the time of generation of the waste and its placement in storage, all due care should be taken to prevent accidental release of PCBs. In the case of PCB equipment, security during interim storage should at least be equivalent to that provided while the equipment was in service.

PCB storage facilities may be built in various sizes. Regardless of size, the same basic concerns should be addressed whether the facility will house a single out-of-service PCB transformer on existing premises or whether it will be a commercially operated facility storing thousands of kilograms of PCBs. In all cases, precautions should be taken to minimize the risk of accidental release of PCBs, and contingency measures, such as spill containment, fire control and emergency response training for personnel, all appropriate to the degree of hazard, should be in place to deal effectively with an emergency should it occur.

In the design of storage facilities, consideration should be given to the quantity and type of PCB equipment or waste to be stored and the frequency of its receipt or transfer. Facilities designed to store only solids, such as empty transformers, do not require as elaborate spill containment as those storing PCB liquids because there is less possibility of PCB leakage. Good judgement, based on individual needs and type and degree of hazard presented, should always be exercised in siting, designing and operating storage facilities.

PCB storage areas should be well identified with signs such as the General Warning label shown in Section 4 or larger signs where appropriate.

3.2 Siting

A PCB storage facility should be located close to the point of generation of the PCB waste. This is to minimize the distance the PCB waste is transported and

thereby decrease the risk associated with transportation. It is realized that this is not always practical for owners of many PCB-containing units spread over a large area. These owners, such as utilities, may prefer centralized storage facilities.

In all cases, PCB storage facilities should be separated from processing and manufacturing activities and only personnel responsible for the operation of the PCB storage facility should be allowed into the storage area. It is recommended that PCB wastes be stored indoors. However, if outdoor storage is unavoidable, the storage area should be covered with a waterproof barrier and should have a collection system for rain water, which could be contaminated with PCBs. Where only PCB-contaminated mineral oil equipment is being stored outside, it may be stored without specially built waterproof barriers or rain water containment systems providing:

- the equipment is structurally sound and sealed from the weather;
- the equipment is identified as being PCB contaminated;
- the stored equipment is maintained, monitored, and secured to the same degree as in-service electrical equipment;
- absolute quantities of PCBs are such that there is no potential for significant environmental contamination in the event of a leak; and
- spill pans and other appropriate spill protection equipment and procedures are utilized during the handling or pumping of liquids.

Small amounts of PCB wastes may be stored in international shipping containers with a suitable steel pan as a floor in lieu of a separate storage building.

3.3 Design

3.3.1 Ventilation. Indoor storage of PCBs provides protection from the weather, permits the control of temperature, and improves the security of the storage. All storage areas should be adequately ventilated and are subject to the regulations and guidelines of the appropriate provincial and federal occupational safety and health agencies. If a mechanical ventilation system is used, it should be controlled by a switch outside the storage room and be energized for several minutes prior to entry. Air intake and exhaust outlets for ventilation systems should be on the building exterior.

3.3.2 Containment. Storage areas should be designed to ensure that PCBs will not be released to the environment. Floors should be made of steel or concrete and equipped with continuous curbing. Concrete should be sealed with a PCB-resistant sealant, such as

a two-component amine-cured epoxy paint similar to Plasite 7122 (Corrosion Services Company Ltd.), Flakeline 660 (Ceilcote Canada Ltd., Toronto) or Valspar 78TC (Valspar Ltd., Toronto). It is recommended that the sealant coating be inspected periodically to check its integrity. The curbing for multi-equipment or container storage should be designed to accommodate twice the liquid content of the largest piece of equipment or container or 25% of the total volume of PCB liquid at the location, whichever is larger. For single-unit storage, accommodation for 125% of the container's volume is acceptable. A 15-cm-high curbing will fulfill the above specifications in most instances, but the curbing may be designed to any height provided it will contain the PCB liquid to the specifications outlined above. All floor drains, pumping systems and sumps leading from the PCB storage location should be sealed to prevent the spread of PCBs from the storage area in the event of a spill. No curbing is required where only solid waste is stored.

3.3.3 Prevention of Water Contamination. Storage facilities should be located and engineered so that PCBs will not be released in the event of flood, storm, or runoff from fire fighting. PCB storage facilities that have outdoor tanks and piping should have the means to manually divert storm water runoff from the site to a holding pond in the event of an emergency. If a PCB release does occur, the runoff collected in these containment systems should be prevented from entering the drainage system until it has been established that the concentration of PCBs does not exceed acceptable limits specified by the appropriate authorities.

3.4 Operation of Storage Facility

PCB wastes should be packaged so as to ensure that the potential for leakage or spills is kept to a minimum, e.g., small pieces of equipment, such as ballasts or capacitors, should be stored in drums or equivalent containers. The containers should be clearly labelled (see Chapter 4) and marked with the date of entry to storage. PCB containers should be placed on pallets and stored where possible in chronological order (as received) to facilitate transfer to a disposal facility. Sufficient space should be left between stored containers to permit inspection and allow the safe movement of vehicles such as forklifts. It is recommended that individual containers not be stacked, unless they are empty, specially designed, or strapped for stability. Askarels should be segregated from combustibles such as Varsol rinsing fluid, oil, soaked rags, and contaminated mineral oil.

Drums used for storing contaminated equipment or solids should be 200-L, No. 18 gauge (or heavier) steel, fitted with removable steel lids and gaskets made of PCB-

resistant material, such as nitrile rubber, cork or Teflon. Drums for the storage of PCB liquids should be double bung, 200-L No. 16-gauge (or heavier) steel.

Large-capacity PCB storage facilities should have a central receiving area where PCB equipment and wastes are loaded and unloaded from transport vehicles. This receiving area should also have a PCB-impervious floor and a containment system to properly control any spills during loading or unloading. The containment system could take the form of impervious dykes or grated drainage trenches connected to an isolated sump. This type of receiving area and containment system should be considered for a large centralized storage facility receiving mainly PCB liquids.

The storage requirements and operational procedures outlined above are directed to the storage of liquids. Requirements for the storage of solids including drained equipment and containers could be less stringent; however, good technical judgement in conjunction with these recommendations should be used.

3.5 Security

3.5.1 Access. Access to a PCB storage area should be restricted to authorized personnel. No other waste should be stored within the area and no manufacturing or other activity should be undertaken. A PCB storage facility may be housed in an occupied building but it should be isolated from other activities. If an isolated room is not available, the facility should be enclosed by a 2-m-high woven mesh fence, or equivalent, with lockable gates. The fence should be clearly labelled to warn people of the presence of PCBs. Personnel protection equipment and clean-up kits for PCB spills (see Section 7.3) should be placed within easy access of the storage area.

3.5.2 Inspection. Askarel liquids in storage should be inspected for leakage monthly. Where only PCB-contaminated oil is stored, inspection every two months is considered adequate. Where only solids or drained equipment is stored, three-month inspection intervals are adequate. Any leaking or deteriorating equipment or containers should be immediately replaced. The facility should be scrupulously maintained. Floors and ventilation systems should be regularly inspected and repaired as required.

3.5.3 Personnel Training. Personnel working at the facility should be made clearly aware of the hazards of PCBs and trained in the use of protection equipment and clean-up procedures. The training programs should be made available to provincial government environmental and labour personnel to give them the opportunity to review and comment on their contents.

3.6 Fire Protection

An indoor central PCB storage facility that contains combustible materials should be equipped with a fully operative fire alarm system and suitable fire extinguishers, such as chemical foam, halon, carbon dioxide, or nitrogen flood. Water should never be used as an extinguishing agent. A system that closes ventilation systems at the first sign of fire is recommended, particularly for large facilities. The operator of a storage facility should contact the local fire department and forewarn them of the presence of PCBs at the storage facility. An updated inventory of wastes and their location should be provided. In this way, the fire department will be prepared to handle a PCB-related fire. Development of a fire control plan and the training of personnel on actions to take during a fire is recommended. For further details see Chapter 7.

4 LABELLING AND RECORD KEEPING

4.1 General

This chapter covers labelling and record-keeping recommendations for in-use and out-of-service PCB equipment, and for PCB liquid and solid waste.

The purposes of labelling are:

- to provide immediate identification of PCB equipment and PCB wastes;
- to alert company officials that the labelled equipment or waste requires special handling and disposal considerations;
- to alert personnel to the presence of PCBs in the event of a spill or leakage; and
- to assist company, provincial and federal officials in maintaining PCB inventories.

The purpose of record keeping is to keep track of PCB equipment and wastes until the PCBs are disposed of.

All equipment and wastes that contain PCBs at concentrations greater than 50 ppm should be labelled. Some owners may find it prudent to also label equipment and wastes that contain PCBs at concentrations of less than 50 ppm even though, strictly speaking, they are not defined as PCB wastes. The reason for this is that spills or leakages could conceivably result in high cleanup costs under certain circumstances and because federal regulations specify the maximum permissable concentration of PCBs in oils for dust control at 5 ppm (3).

The labelling of in-service equipment is voluntary; however, it is strongly recommended by Environment Canada and, to date, industry has cooperated fully. Additional guidance on the labelling of in-service equipment is provided in reference (12).

Where PCB users have developed their own labelling and reporting procedures, these procedures should incorporate the functions of the system described in this chapter.

Under the Transportation of Dangerous Goods Regulations, safety marking is mandatory for the offering for transport and transportation of PCB wastes and equipment. The Transportation of Dangerous Goods Regulations are discussed in Chapter 5.

4.2 Labelling of In-service Equipment

The proper labelling (12) of in-service PCB equipment will ensure that it is correctly identified when it enters the waste stream. The PCB label also alerts people to the presence of PCBs in the equipment and assists in inventory control while in-service, and later, during handling, storage, and disposal.

4.2.1 Askarel Equipment. Environment Canada recommends four labels for PCB equipment (Figures 1 to 3). The first two (Figure 1) are serialized and have an Environment Canada registration number at the bottom. These numbers allow Environment Canada to keep track of the amounts and locations of askarel equipment and liquids. All askarel equipment and containers of sufficient physical size to take a label should be labelled with one of the two serialized labels.

The label shown in Figure 1a) measures 15 x 15 cm and should be used on large askarel equipment and containers, such as transformers and drums. Once affixed, the label should only be removed if the equipment or container has been decontaminated and EC is satisfied that the PCB concentration is less than 50 ppm.

The label shown in Figure 1b) measures 7.6 x 7.6 cm and should be used for small items, such as capacitors, where size permits. Where a number of smaller pieces of PCB equipment are found together, such as a capacitor bank, one label may be used for the entire group; however, when a capacitor is removed from the bank for disposal, it should be labelled. Equipment that contains small PCB articles, for example a radio transmitter that contains PCB capacitors, does not have to be labelled.

A non-serialized version of the 15 cm x 15 cm label is shown in Figure 2. It is to be used as a general warning label and should be placed in a clearly visible position at the entrances to locations where PCB equipment is found. Some examples of these locations are fenced storage compounds, electrical rooms and transformer vaults.

4.2.2 PCB-contaminated Equipment. The PCB concentration in PCB-contaminated equipment (e.g., a PCB-contaminated mineral oil transformer) is much lower than that found in equipment using askarels. Nevertheless, if the PCB concentration is greater than 50 ppm, this equipment poses a potential hazard and is subject to the same regulations (Chlorobiphenyl Regulations No. 1 and No. 3) that apply to equipment containing askarels. When it is suspected that a piece of equipment may be contaminated with PCBs, and an activity is to be carried out to which the regulations apply, then the fluid contained in the equipment should be tested. If PCBs are found, a PCB warning label for contaminated equipment should be placed on the equipment. This label (Figure 3) has space for entering the following information: PCB concentration, date of analysis, company name and the signature of an authorized company official. This label, or an appropriate equivalent, should also be used to identify drums, tanks or packaging where contaminated mineral oils, rinsing fluids, or other low level PCB contaminated wastes are stored.

All of the labels discussed above are available in limited quantities from the regional and district offices of Environment Canada (see Appendix F).

ATTENTION
CONTAINS PCB CONTIENT DES
POLYCHLORINATED BIPHENYLS BIPHÉNYLES POLYCHLORÉS
A TOXIC ENVIRONMENTAL CONTAMINANT SCHEDULED UNDER THE ENVIRONMENTAL CONTAMINANTS ACT. IN CASE OF ACCIDENT, SPILL OR FOR DISPOSAL INFORMATION, CONTACT THE NEAREST OFFICE OF THE ENVIRONMENTAL PROTECTION SERVICE, ENVIRONMENT CANADA.
PRODUITS TOXIQUES MENTIONNÉS DANS L'ANNEXE DE LA LOI SUR LES CONTAMINANTS DE L'ENVIRONNEMENT. EN CAS D'ACCIDENT, OU DE DÉVERSEMENT, OU POUR SAVOIR COMMENT LES ÉLIMINER, CONTACTER LE BUREAU DU SERVICE DE LA PROTECTION DE L'ENVIRONNEMENT, MINISTÈRE DE L'ENVIRONNEMENT LE PLUS PRÈS.
OR 26900

a) **Label for Large Equipment**

b) **Label for Small Equipment**

FIGURE 1 LABELS FOR PCB EQUIPMENT

ATTENTION
PCB
CONTAINS
POLYCHLORINATED BIPHENYLS
CONTIENT DES
BIPHÉNYLES POLYCHLORÉS
A TOXIC ENVIRONMENTAL CONTAMINANT SCHEDULED UNDER THE ENVIRON MENTAL CONTAMINANTS ACT. IN CASE OF ACCIDENT SPILL OR FOR DISPOSAL INFORMATION, CONTACT THE NEAREST OFFICE OF THE ENVIRONMENTAL PROTECTION SERVICE, ENVIRONMENT CANADA.
PRODUITS TOXIQUES MENTION- NÉS DANS L'ANNEXE DE LA LOI SUR LES CONTAMINANTS DE L'ENVIRONNEMENT. EN CAS D'ACCIDENT, OU DE DÉVERSEMENT, OU POUR SAVOIR COMMENT LES ÉLIMINER, CONTACTER LE BUREAU DU SERVICE DE LA PROTECTION DE L'ENVIRONNEMENT, MINISTÈRE DE L'ENVIRONNEMENT LE PLUS PRÈS.

FIGURE 2 PCB GENERAL WARNING LABEL

ATTENTION

CONTAMINATED WITH PCBs (POLYCHLORINATED BIPHENYLS)	CONTAMINÉ PAR BPCs (BIPHÉNYLES POLYCHLORÉS)
THE CONTENTS OF THIS EQUIPMENT ARE CONTAMINATED WITH PCBs, AN ENVIRONMENTAL CONTAMINANT SCHEDULED AND REGULATED UNDER THE ENVIRONMENTAL CONTAMINANTS ACT. IN CASE OF ACCIDENT, SPILL OR FOR DISPOSAL INFORMATION, CONTACT THE NEAREST OFFICE OF THE ENVIRONMENTAL PROTECTION SERVICE, ENVIRONMENT CANADA.	LE CONTENU DE CET APPAREIL EST CONTAMINÉ PAR DES BPCs, UN CONTAMINANT ENVIRONNEMENTAL ANNEXÉ ET RÉGLEMENTÉ EN VERTU DE LA LOI SUR LES CONTAMINANTS DE L'ENVIRONNEMENT. EN CAS D'ACCIDENT, OU DE DÉVERSEMENT, OU POUR SAVOIR COMMENT LES ÉLIMINER, CONTACTER LE BUREAU LE PLUS PROCHE DU SERVICE DE LA PROTECTION DE L'ENVIRONNEMENT, MINISTÈRE DE L'ENVIRONNEMENT.

PCB CONCENTRATION (parts per million)
CONCENTRATION DE BPC (parties par million) _____

DATE ANALYZED
DATE D'ANALYSE _____

COMPANY NAME
NOM DE LA COMPAGNIE _____

AUTHORIZED COMPANY OFFICIAL
AGENT OFFICIEL AUTORISÉ _____

FIGURE 3 PCB WARNING LABEL FOR CONTAMINATED EQUIPMENT

4.3 Labelling of PCB Waste

All labels applied to in-service equipment according to the recommendations given previously should be left on that equipment when it becomes waste material, unless liquids have been decontaminated to less than 50 ppm of PCBs. Additional safety marking requirements for PCB wastes, pursuant to the Transportation of Dangerous Goods Regulations, are described in Chapter 5.

4.4 Record Keeping and Retention

4.4.1 Record Keeping for In-service Equipment. Environment Canada maintains an inventory of all askarel and PCB-contaminated equipment that has been labelled. During inspections, this equipment may be identified, checked against the inventory list, and have its status updated if necessary. The Environment Canada office in the appropriate region should be informed whenever an organization alters the status of a piece of PCB equipment, e.g., if it is taken out of service, re-located, stored, decontaminated, or disposed of. See Appendix F for a list of Environment Canada offices where notification can be made.

4.4.2 Record Keeping in Storage and Disposal. Each owner or operator of a facility for the storage of PCB wastes should keep records which include:

- the date and source of PCB waste transferred to storage and the date and destination of waste leaving storage;
- a description of the wastes, including the mass of PCBs, received at the facility or transferred to other facilities;
- identification number for the PCB waste (this can be the identification number from the label described in Section 4.2);
- date and quantity of PCBs spilled as a result of a leak or accident and clean-up procedures adopted; and
- dates and details of inspections by Environment Canada, the owner and provincial authorities.

The owner or operator of a disposal facility should maintain records in a manner similar to that for a storage facility with the inclusion of information on:

- the quantity of PCB wastes disposed of and the method(s) used;
- quantities and disposal methods for residues produced; and

- monitoring data appropriate to the particular disposal method(s) used (see Appendices C and D).

Owners of PCB equipment or PCB wastes should retain a record of their inventory for five years after removal or disposal of the last of their PCBs. During that time, the annual inventory reports will confirm the disposal of the PCBs and will enable the provinces and Environment Canada to verify the reduction and eventual exhaustion of the PCB inventory. This recommendation also applies to owners and operators of storage and disposal facilities.

This maintenance of records will parallel the requirements of the Transportation of Dangerous Goods Regulations except that, under the regulations, documents related to transportation are required to be kept for only two years.

5 TRANSPORTATION

5.1 General

The federal Transportation of Dangerous Goods Regulations, and complimentary provincial legislation, specify standards and requirements for the safe handling and transporting, by all modes of transportation within Canada, of dangerous goods and/or hazardous wastes. The federal regulations apply to all domestic consignments by air, marine and rail transportation, and to all inter-provincial, transborder (Canada and the U.S.A.) by road and rail, and international (Canada and another country by aircraft or by ship) consignments. Provincial regulations apply to road consignments within a province. The federal and provincial regulations also cover safety markings, documentation, packaging, safety and emergency reporting requirements, and training of personnel. Under the TDG regulations, PCBs or articles containing PCBs have a primary classification number of 9.1, a subsidiary classification number of 9.2 and a Product Identification Number (PIN) of 2315.

Under provincial hazardous waste legislation, it may also be necessary for the consignor (generator), carrier, and consignee (receiver) involved in the transportation of PCB wastes and equipment to obtain approvals or licenses that specify further contractual responsibilities for these parties.

Another federal regulation applicable to the transportation of PCBs is the Chlorobiphenyl Regulations No. 3 (Release) which specifies that the maximum quantity of PCBs that may be released to the environment during the transportation of transformers, capacitors, heat transfer and hydraulic equipment, electromagnets and vapor diffusion pumps, or any package containing PCB equipment, is one gram per day for any one piece of equipment or any one package of equipment.

5.2 Definitions

The following definitions are from the recent amendment (SOR/86-526, Canada Gazette II, May 28, 1986) of the Transportation of Dangerous Goods Act and apply to all road and rail PCB transportation-related activities subject to the regulations.

Electrical Equipment means a piece of equipment that:

(a) contains a PCB mixture;

(b) is used in the transmission or distribution of 60 Hz, 25 Hz or high voltage direct current (HVDC) electrical power;

(c) is designed to perform a function other than solely to contain the PCB mixture; and

(d) is normally leak-free while in service.

PCB Article means any article that contains a PCB mixture, but does not include electrical equipment, a packaging or a container.

PCB Mixture means a mixture containing PCBs in a concentration greater than 50 parts per million by weight.

Serviceable Electrical Equipment includes electrical equipment that:

(a) may show evidence of leakage;

(b) is temporarily out of service for the purpose of maintenance, repair or relocation; and

(c) is not in temporary storage for the purpose of disposal.

Larger Container means a container with a capacity greater than 454 L.

5.3 Exemptions

The recent amendments to the Transportation of Dangerous Goods Regulations provide a regulatory scheme for the transportation of PCB materials, equipment and articles contaminated with PCBs and provide certain exemptions for small-quantity samples, articles and wastes, and some types of electrical equipment containing PCBs. Securely packaged (including absorbent) samples, solids in quantities less than 10 kg gross weight and liquids when their net quantity is the lesser of 2 L or 2 kg are exempt. When a waste is a PCB mixture, or a PCB article or electrical equipment containing a PCB mixture, it is also exempt if the quantity of PCB mixture is not greater than 500 g. PCB articles in leak-free condition and containing not greater than 500 g of PCB mixture are exempt from all regulation.

Certain electrical equipment is exempt from most regulatory requirements, (except those requirements for dangerous occurrence reporting), provided specific conditions of transport are met. In particular, equipment never designed to operate with PCBs, but nonetheless contaminated with PCBs, is treated in this fashion if it is being transported for servicing, relocation or for use as an emergency replacement. This situation applies to all such equipment only if it contains less than 500 L of PCB liquid and is in leak-free condition.

The additional conditions for transportation for this type of equipment and those for all other PCB mixtures, articles, and equipment are discussed in Section 5.5.

5.4 Safety Marking and Documentation

PCBs in containers or articles, or equipment containing PCBs, when offered for transport, must be labelled as shown in Figures 4 and 5, and the containers, articles or equipment must clearly show the shipping name and the PIN number.

When PCBs are to be transported in a large container or transport unit a Class 9 placard (Figure 6) must be displayed. An exception to this rule is for PCB goods (i.e., not PCB wastes) in road vehicles travelling solely on land and when the gross quantity of PCB goods is less than 500 kg. No such exception applies for PCB wastes.

Under the Transportation of Dangerous Goods Regulations, two documentation requirements affect shipments of PCB wastes. Consignments of PCB waste destined for or imported from any international or Canada/U.S. location are subject to a 60-day advance notification requirement. This prenotification must contain specific information, including the identity of all parties involved in the shipment (including a confirmation of generator/receiver contractual arrangements), a description of the waste, the quantity involved, the packaging and means of transport, the ports of entry and/or exit, and the approximate date of shipment of the consignment. Such a prenotification can cover a series of consignments over a calendar year if estimated shipping dates for each consignment in such a series are given. However, seven days before the intended shipping date of the second and each subsequent consignment in a series, the shipper must again notify both Transport Canada and Environment Canada.

Before dangerous goods that are PCB mixtures or articles or equipment containing PCBs are transported, the consignor must prepare and sign a shipping document and deliver it to the initial carrier. When the consignment is waste PCB mixtures or waste articles or equipment containing PCBs, a manifest form (Figure 7) is required for each shipment. Completion of part A of the form is the responsibility of the consignor (generator) and Part B of the carrier. The manifest form then accompanies the shipment during transport to the consignee (receiver) who must check the shipment on receipt for any discrepancies and ensure that it matches the description on the manifest before completing Part C of the manifest. The required distribution of the various copies of the manifest is shown in Figure 8 (13).

For PCB equipment, the manifest's Special Handling Section should include the Environment Canada (EC) inventory number so that, by exchange of information between the provincial environment ministries and Environment Canada, the EC inventory can be updated.

black / noir
white / blanc
ATTENTION
CONTAINS PCB-DPC CONTIENT DES
POLYCHLORINATED BIPHENYLS DIPHÉNYLES POLYCHLORÉS
A TOXIC ENVIRONMENTAL CONTAMINANT SCHEDULED UNDER THE ENVIRONMENTAL CONTAMINANTS ACT IN CASE OF ACCIDENT SPILL OR FOR DISPOSAL INFORMATION CONTACT THE NEAREST OFFICE OF THE ENVIRONMENTAL PROTECTION SERVICE ENVIRONMENT CANADA
PRODUITS TOXIQUES MENTIONNÉS DANS L'ANNEXE DE LA LOI SUR LES CONTAMINANTS DE L'ENVIRONNEMENT EN CAS D'ACCIDENT OU DE DÉVERSEMENT OU POUR SAVOIR COMMENT LES ÉLIMINER CONTACTER LE BUREAU DU SERVICE DE LA PROTECTION DE L'ENVIRONNEMENT MINISTÈRE DE L ENVIRONNEMENT LE PLUS PRÈS

FIGURE 4 TDGA PCB LABEL

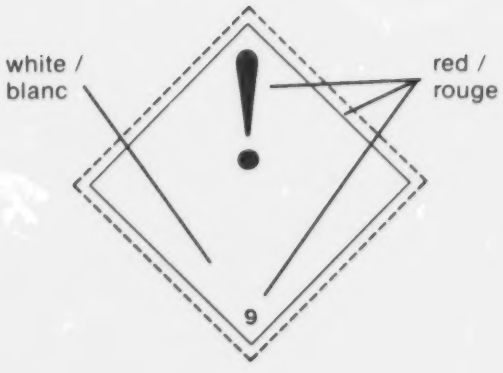


FIGURE 5 TDGA CLASS 9 LABEL

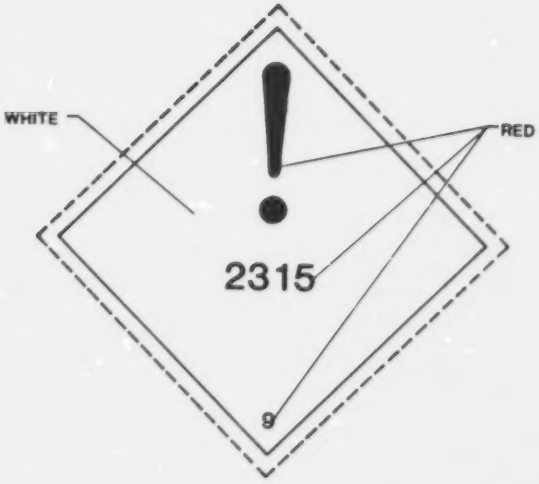


FIGURE 6 TDGA CLASS 9 PLACARD

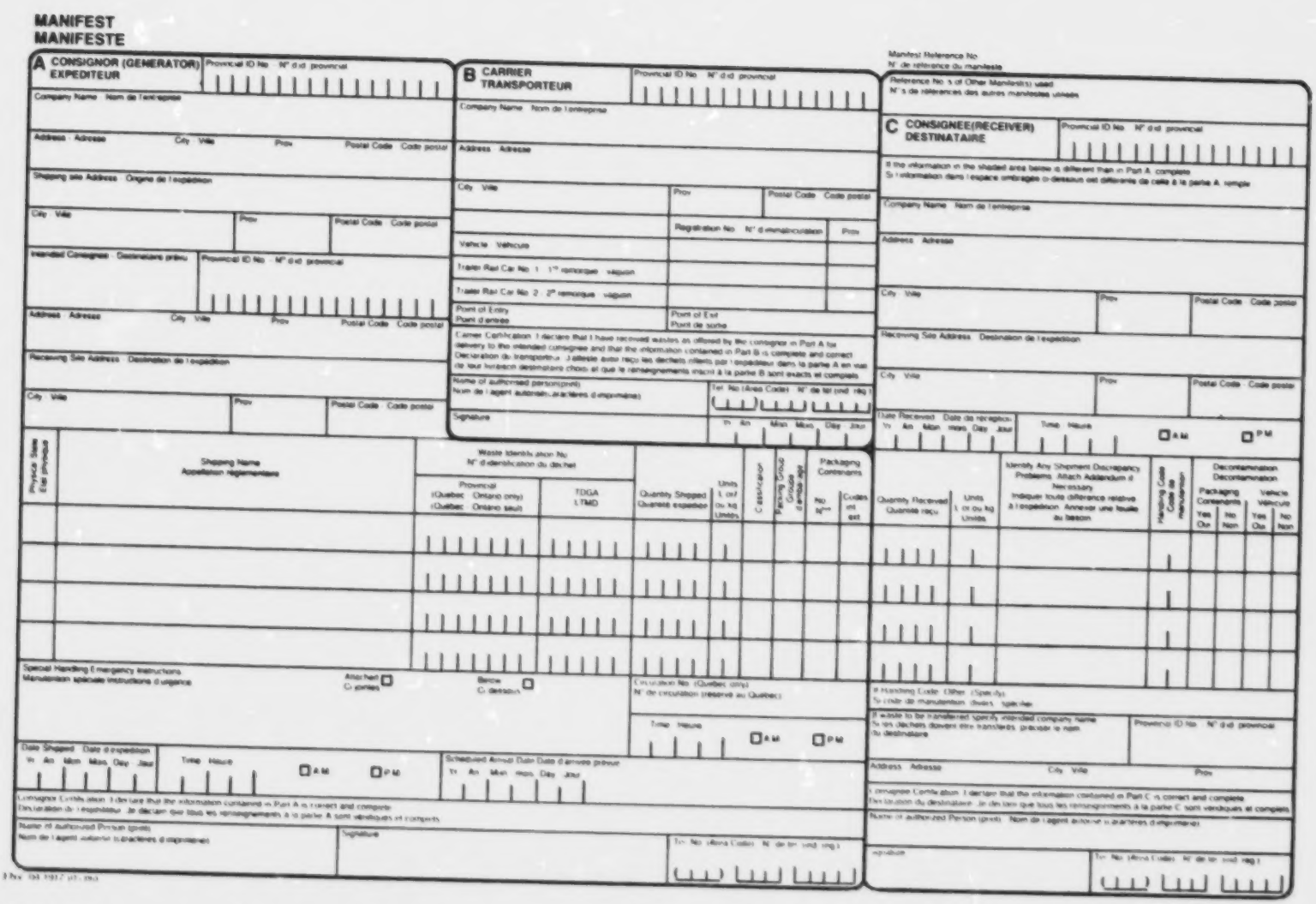
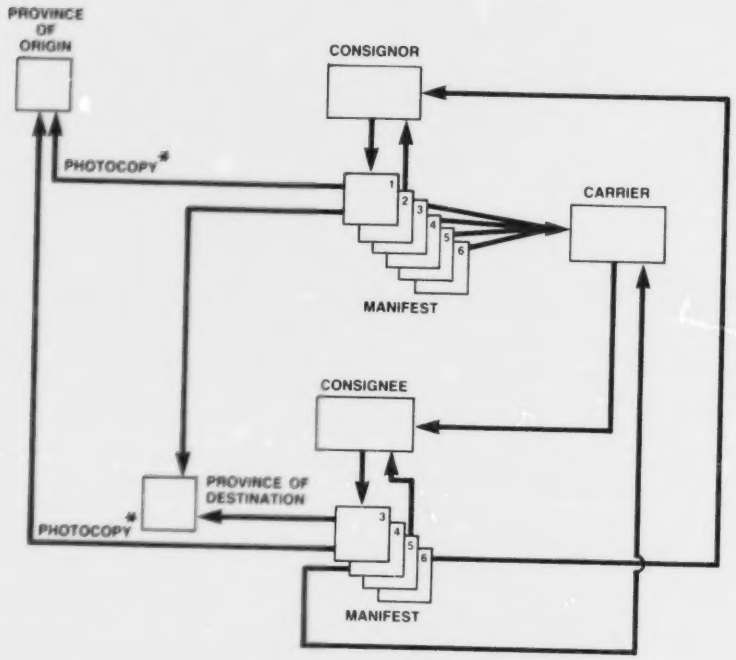


FIGURE 7 TDGA WASTE MANIFEST



* When the province of origin and destination is different.

FIGURE 8 DISTRIBUTION OF MANIFEST COPIES

There is one additional documentation requirement. In the event of a spill of 50 kg or more of a PCB mixture during transportation-related activities, a Dangerous Occurrence Report Form (Figure 9) must be completed as required by the Transportation of Dangerous Goods Regulations.

Depending upon provincial requirements, additional information may be required for shipments of waste PCB mixture and waste articles/equipment containing PCBs.

5.5 Packaging

To avoid problems under normal transportation conditions, the Transportation of Dangerous Goods Regulations require that articles containing a PCB mixture be securely enclosed in a leak-proof container suitable for PCBs.

PCB mixtures not contained in articles or equipment must be packaged in suitable liquid-tight containers that conform to relevant specifications in Rules 40, 41 or 54 of CFC 6000 (Canadian Freight Classification CFC 6000 January 1979, Canadian Freight Association).

Transport Canada / Transports Canada

TRANSPORTATION OF DANGEROUS GOODS

DANGEROUS OCCURRENCE REPORT

AS REQUIRED UNDER THE TRANSPORTATION OF DANGEROUS GOODS REGULATIONS (SECTION 9.14)

TRANSPORT DES MARCHANDISES DANGEREUSES

RAPPORT SUR UN CAS DE DANGER

PRESCRIT EN VERTU DU REGLEMENT SUR LE TRANSPORT DES MARCHANDISES DANGEREUSES (ARTICLE 9.14)

1 TYPE OF DANGEROUS OCCURRENCE — GENRE DE CAS DE DANGER
(CHECK ALL APPLICABLE BOXES) (COCHEZ TOUTES LES CASES APPLICABLES)

☐ SPILL / EPANCHEMENT ☐ LEAK / FUITE ☐ CONTAMINATION
A ☐ HUMAN / DES PERSONNES B ☐ PROPERTY / DES BIENS C ☐ ENVIRONMENT / DE L'ENVIRONNEMENT
☐ EXPLOSION ☐ FIRE / INCENDIE

2 DATE OF DANGEROUS OCCURRENCE — DATE DU CAS DE DANGER
Y A M D J

3 TIME OF DANGEROUS OCCURRENCE (24 HR SYSTEM)
HEURE DU CAS DE DANGER (SUR 24 HEURES)

4 LOCATION OF DANGEROUS OCCURRENCE (BE SPECIFIC)
LIEU DU CAS DE DANGER (PRECISEZ)

5
☐ RESIDENTIAL AREA / ZONE RESIDENTIELLE ☐ COMMERCIAL AND RESIDENTIAL AREA / ZONE COMMERCIALE ET RESIDENTIELLE
☐ URBAN CORE AREA / CENTRE VILLE ☐ INDUSTRIAL AREA / ZONE INDUSTRIELLE ☐ RURAL AREA / ZONE RURALE

6 DANGEROUS OCCURRENCE HAPPENED — LE CAS DE DANGER S'EST PRODUIT DURANT
☐ DURING TRANSPORT / LE TRANSPORT ☐ DURING HANDLING (SPECIFY) / LA MANUTENTION (PRECISEZ) ☐ DURING TEMPORARY STORAGE / L'ENTREPOSAGE TEMPORAIRE
☐ OTHER (SPECIFY) / AUTRE (PRECISEZ)

7 COMPLETE A OR B — REMPLIR A OU B

(A) DANGEROUS OCCURRENCE DURING TRANSPORT
(A) CAS DE DANGER DURANT LE TRANSPORT

(1) MODE OF TRANSPORT — MODE DE TRANSPORT
☐ ROAD / ROUTIER ☐ RAIL / FERROVIAIRE
☐ AIR / AERIEN ☐ MARINE / MARITIME

(2) TYPE OF VEHICLE — GENRE DE VEHICULE

(3) CARRIER (NAME AND ADDRESS) — TRANSPORTEUR (NOM ET ADRESSE)

POSTAL CODE — CODE POSTAL

OR / OU

(B) DANGEROUS OCCURRENCE DURING HANDLING OR TEMPORARY STORAGE
(B) CAS DE DANGER DURANT LA MANUTENTION OU L'ENTREPOSAGE TEMPORAIRE

(1) FACILITY — INSTALLATION
TERMINAL ☐ AIR / AERIEN ☐ RAIL / FERROVIAIRE ☐ ROAD / ROUTIER
PORT ☐ ON SHORE / AU QUAI ☐ ON SHIP / A BORD D'UN NAVIRE
☐ WAREHOUSE / ENTREPÔT ☐ BULK STORAGE PLANT / INSTALLATION D'ENTREPOSAGE EN VRAC
☐ OTHER (SPECIFY) / AUTRE (PRECISEZ)

(2) FACILITY (NAME AND ADDRESS) — INSTALLATION (NOM ET ADRESSE)

POSTAL CODE — CODE POSTAL

8 CONSIGNOR — EXPÉDITEUR
NAME — NOM
ADDRESS — ADRESSE
POSTAL CODE — CODE POSTAL

9 ORIGIN OF CONSIGNMENT — POINT D'ORIGINE DE L'ENVOI

10 DESTINATION OF CONSIGNMENT — POINT DE DESTINATION DE L'ENVOI

16-0013 (2-85)

FIGURE 9 DANGEROUS OCCURRENCE REPORT FORM

11 DANGEROUS GOODS INVOLVED IN THE OCCURRENCE WERE
LES MARCHANDISES DANGEREUSES EN CAUSE DANS LE CAS DE DANGER ETAIENT

☐ IN BULK / EN VRAC ☐ PACKAGED / DANS DES COLIS ☐ IN CONTAINERS / DANS DES CONTENEURS

P I N / NIP	CLASSIFICATION	SHIPPING NAME — APPELLATION REGLEMENTAIRE	TYPE OF PACKAGE / GENRE DE COLIS	TOTAL MASS OR VOLUME OF SHIPMENT / MASSE OU VOLUME TOTAL DE L'ENVOI	MASS OR VOLUME OF ESTIMATED LOSS / MASSE OU VOLUME DES PERTES ESTIMATIVES

12 DESCRIBE THE EVENTS LEADING TO, DURING AND RESULTING FROM THE DANGEROUS OCCURRENCE
DECRIVEZ LES CIRCONSTANCES AYANT CONDUIT AU CAS DE DANGER ET CELLES QUI PREVALAIENT DURANT ET APRES LE CAS DE DANGER

13 NUMBER OF DEATHS
NOMBRE DE DECES

14 NUMBER OF INJURED PERSONS REQUIRING HOSPITALIZATION
NOMBRE DE BLESSES QUI ONT DU ÊTRE HOSPITALISES

15 EVACUATION OF SURROUNDING AREA
EVACUATION DES ENVIRONS

☐ YES / OUI ☐ NO / NON

16 EMERGENCY RESPONSE PERSONNEL AT SITE OF DANGEROUS OCCURRENCE
PERSONNEL D'INTERVENTION D'URGENCE SUR LES LIEUX

☐ POLICE ☐ FIRE DEPARTMENT / SERVICE D'INCENDIE ☐ OTHER / AUTRE

17 COMMENTS AND ADDITIONAL INFORMATION — COMMENTAIRES ET RENSEIGNEMENTS SUPPLEMENTAIRES

18 PERSON COMPLETING THIS FORM — FORMULE REMPLIE PAR

NAME — NOM _____ TITLE — TITRE _____

ADDRESS — ADRESSE _____ TELEPHONE — TELEPHONE AREA CODE / CODE REG. ( )

I CERTIFY THAT THIS INFORMATION IS ACCURATE TO THE BEST OF MY KNOWLEDGE
J'ATTESTE QUE LES RENSEIGNEMENTS CI-DESSUS SONT EXACTS AU MEILLEUR DE MA CONNAISSANCE

SIGNATURE _____ DATE _____

SEND TO: TRANSPORT DANGEROUS GOODS, TDGA / T. TRANSPORT CANADA
ENVOYEZ A: TRANSPORT DES MARCHANDISES DANGEREUSES, TDGA / T. TRANSPORTS CANADA OTTAWA, ONT K1A 0N5

FIGURE 9 DANGEROUS OCCURRENCE REPORT FORM (CONT'D)

Serviceable electrical equipment that is exempt under the conditions described in Section 5.3 must be transported in its normal operating position. Serviceable electrical equipment used as emergency replacement for stationary equipment must also be permanently mounted on a railway or road vehicle. This type of equipment, if it is drained, must have any remaining PCB mixture contained in the base below the drain opening. When transportation occurs by road vehicles, the equipment must be inspected by the carrier every two hours or every 200 km, whichever is more frequent.

All other serviceable electrical equipment (i.e., that not exempt in Section 5.3 and that containing greater than 500 L PCB mixture) and PCB electrical equipment, either in use or waste, must be transported in the following manner. The equipment must first be drained to the greatest extent possible over 48 hours before all orifices are capped or sealed. The equipment is then protected by a means of containment that will prevent any escape of remaining liquid; sufficient absorbent material is placed inside the containment to absorb the remaining liquid; and finally, the entire equipment plus containment is covered to protect against the weather.

One final type of packaging for transport may be necessary. The regulations presently offer an alternative method for transporting electrical equipment, when it is impossible or inadvisable to drain the equipment before transport. In such instances, transportation can proceed if the equipment is placed in a leakproof container. If complete containment is not feasible, the equipment must be placed in a drip pan with a capacity of 125% of the nameplate capacity of the equipment; the drip pan must be filled with sufficient absorbant material to absorb 110% of the equipment's capacity; and the entire equipment and drip pan must be covered to protect against the weather.

When packaging PCB liquids for transport (e.g., askarel, PCB-contaminated mineral oil, solvent flushings, or water), the liquids should be pumped rather than poured into containers, leaving a 7- to 10-cm air space for liquid expansion; full open head containers must not be used.

5.6 Safety During Transport

All containers and vehicles should be inspected for mechanical defects and leaks; any leaks must be cleaned up using sorbents and/or solvents listed in Chapter 7.

According to the Transportation of Dangerous Goods Regulations, no person shall handle, offer for transport or transport PCBs or articles containing PCBs, including waste, unless he is trained to do so, or is performing those activities under the direct supervision of a trained person. A person is considered suitably trained:

(a) when his employer

(i) is satisfied that the person has received adequate training in the aspects of the handling, offering for transport or transporting of dangerous goods related to the duties that he proposes to assign to the person, and

(ii) issues to the person a Certificate of Training that indicates

(A) the date the person completed an initial training in the handling, offering for transport or transporting of dangerous goods,

(B) the date the person completed each subsequent training in the handling, offering for transport or transporting of dangerous goods, if any, and

(C) the aspects of the handling, offering for transport or transporting of dangerous goods for which the person was trained; or

(b) when the person is the holder of a certificate, licence or authorization recognized under:

(i) the Ships' Deck Watch Regulations,

(ii) The Pest Control Products Act,

(iii) the Regulations No. 0-8, Uniform Code of Operating Rules, or

(iv) the Atomic Energy Control Act.

and the certificate, licence or authorization relates, at least in part, to the aspects of handling, offering for transport or transporting of dangerous goods that are applicable to his assigned duties.

In the case of an incident involving PCBs, transportation personnel must be fully aware of the requirement to notify the appropriate provincial/territorial emergency authority at the emergency telephone numbers listed on the waste manifest (Figure 7). Information on dealing with PCB releases can also be obtained from a 24-hour hotline service called CANUTEC operated by Transport Canada, which can be reached at (613) 996-6666.

The appropriate provincial environmental authority should be informed of spills and clean-up measures being taken. Environment Canada should also be contacted where they are considered by the provincial authority to have the best information on emergency and spill clean-up procedures.

6 DISPOSAL OF PCBs

6.1 General

A critical issue in the management of PCB waste is the PCB concentration or mass at which a material is defined as a PCB waste. Two criteria are applied:

- any material containing more than 50 ppm PCBs; and
- any capacitor containing more than 0.5 kg PCBs.

As a general guide, any PCB capacitor with a volume greater than 1250 cm^3 (76.3 cubic inches) will be considered to contain in excess of 0.5 kg PCBs.

The above does not mean that PCB wastes that do not meet these criteria should be disposed of indiscriminately or routinely go to municipal landfills. Low-concentration or small-quantity PCB wastes should be addressed individually and disposed of in accordance with provincial regulations or requirements.

A specific restriction on the disposal of PCBs in concentrations lower than 50 ppm is given in Chlorobiphenyl Regulations No. 3 (3); the maximum concentration of PCBs in oil applied to a road surface is limited to 5 ppm. This limit was imposed because of the potential for contamination of surface water and sediments from runoff from roads.

An exemption for capacitors containing less than 0.5 kg of PCBs is included to allow for the practical difficulties in attempting to channel small capacitors in home appliances, electronic equipment and fluorescent light ballasts (14) to destruction facilities or approved landfills. This exemption is in keeping with the 0.5 kg exemption for PCB mixtures in the May 26, 1986, amendments to the Transportation of Dangerous Goods Act Regulations. As a general principle, however, where possible, small capacitors should be segregated and collected for handling and disposal as PCB waste.

As previously mentioned, no commercial facilities in Canada accept PCB wastes for disposal. Since 1980, the U.S. border also has been closed to shipment of PCB wastes in to the U.S. Several federal/provincial initiatives are underway to develop commercial facilities.

A summary of disposal technologies for the various types of PCB wastes most frequently encountered in practice is given in Table 3, and brief descriptions of these technologies follow.

TABLE 3 DISPOSAL TECHNOLOGIES FOR VARIOUS PCB WASTES

Waste Type [a]	Typical PCB Content	Disposal Option						
		Liquid Injection Incinerator	Rotary Kiln Incinerator	High Efficiency Boiler [c]	Material Recovery	Approved Landfill	Municipal Landfill [d]	Sodium - based Processes
Askarel	30-70%	●	○					
Decontamination Flushing (Concentrated)	1-10%	○	○					
Decontamination Flushings	<1%	○	○	○				
Mineral Oil	<1%	○		○	○			○
Retrofilling Fluids	100-1000 ppm	○		○	○			
Major Equipment [b]	<500 ppm				●	○		
Major Equipment [b]	≤50 ppm				●		○	
Large Capacitors	>0.5 kg		●					
Small Capacitors	≤0.5 kg		●			○	○	
Maintenance Waste	varies		●					
Packaging	varies		●					
Waste Lubricating Oil	10-500 ppm	○		○				○
Soil, Demolition Spoils and PCB Destruction Residues	>50 ppm		●			○		
Dredging Spoils	varies		●			○		
Aqueous Waste	µg/L to mg/L	○		○				

● Recommended
○ Possible options

Where no option is recommended, the best option must be determined case-by-case, depending upon such variables as degree of contamination, costs, and availability of option.

a See Appendix B for broader descriptions of wastes.
b Drained equipment.
c Limited to PCB concentrations < 500 ppm.
d Not recommended, although unregulated small PCB capacitors in light ballasts, electronic equipment and appliances, and small quantity PCBs in equipment, soils or residues are sometimes disposed of here.

6.2 Technologies

6.2.1 Liquid Injection Incinerators. These incinerators burn a support fuel and accept PCB liquid wastes as part of their total fuel requirements. Although they are not designed to accept solids, some ash is usually manageable so that pumpable sludges can be incinerated. The incinerator should be fitted with a gas scrubbing system to remove by-product hydrogen chloride from the flue gas. Liquid injection incineration is currently the preferred technology for the destruction of high-concentration PCB fluids, such as askarels, and may also be used for aqueous wastes from which PCBs cannot be economically removed. The U.S. Environmental Protection Agency (EPA) combustion criteria and related operating conditions and controls for PCB liquid injection incinerations are given in Appendix C.

Kokoszka and Kuntz (15) have summarized the advantages and disadvantages of this destruction technology. The advantages of liquid injection incinerators include the ability to handle a variety of liquid wastes, no moving parts in the combustion chamber, the capability of operating over a wide range of feed rates, and low maintenance cost. The disadvantages include plugging and corrosion of burners due to incompatible fluids, the need for liquids to have low enough viscosities not only to be pumped but also to be atomized in the burner, and the need for sophisticated instrumentation to maintain the required combustion efficiency because these incinerators are highly sensitive to changes in waste composition and flow.

6.2.2 Rotary Kiln Incinerators. This type of incinerator is recommended for wastes containing mainly solid materials and, in many cases, the wastes (e.g., capacitors) will be shredded before entering the kiln. Provision should be made to prevent the escape of vapour-phase PCBs during shredding. This can be accomplished by hooding, operational sequencing of gates, and providing an air flow through the system that becomes the combustion air source. Large quantities of solid residues are produced; the major portion is usually dropped out after the rotary kiln section and the remainder is removed by the emission control system. The residence time of solids in the kiln is usually about 30 minutes. The gases from the rotary kiln are passed into a second incineration zone, which is typically a liquid injection incinerator. Operating conditions for this type of incinerator are given in Appendix C.

Some advantages of rotary kiln incinerators are the capabilities to handle solids and liquids, either separately or in combination, to handle large containers, and to adjust residence time for solids by varying the rotational speed of the kiln (15). Some

disadvantages are that the units have a relatively high capital cost; emission control is necessary for particulates and hydrogen chloride; and the seals on the kiln ends and feed chute may leak (15).

6.2.3 High Efficiency Boilers. Many companies or utilities that have PCB wastes also own high efficiency industrial boilers which are used for steam and/or electricity generation. These boilers, fired by oil, coal or natural gas, often approach the time and temperature regimes of liquid injection incinerators. Energy recovery and decreased transportation of PCB wastes provide an incentive to use these boilers to destroy PCBs. However, the boilers are often limited in their capability to destroy PCBs by their lack of hydrogen chloride emission control systems, marginal time-temperature conditions or boiler metallurgy (chloride resistant) (16). As a result, the use of high efficiency boilers is restricted to liquid wastes containing less than 500 ppm PCBs. U.S. EPA criteria for the use of a high efficiency boiler are given in Appendix D.

6.2.4 Dechlorination Using Sodium-based Processes. Sodium-based dechlorination processes can be used to decontaminate mineral oil containing up to a few thousand parts per million PCBs; the upper concentration limit is set by process costs in each case. In this process, the sodium reagent reacts with the chlorine atoms on the PCB molecule to form sodium chloride, and the biphenyl part of the PCB molecule polymerizes to form a non-chlorinated polymer (polyphenylene); the mineral oil is unchanged. Sodium chloride and polyphenylene are the wastes from this process. The PCB-free mineral oil can be reused or disposed of as a non-hazardous waste. Dechlorination of PCBs by sodium reagents must be conducted in a nitrogen or other inert atmosphere to prevent the fire hazard created when hydrogen is generated by reaction of the sodium reagent with any moisture in the oil. Sodium-based dechlorination processes cannot be used to treat PCBs in oil containing significant amounts of water (9).

Sodium-based processes are recommended for treatment of PCB-contaminated mineral oil because the systems can be brought directly to the PCB source, and the decontaminated mineral oil can be reused.

6.2.5 Approved Landfills. In this manual the term "approved landfill" means a landfill that is permitted to accept designated wastes in controlled quantities and concentrations and that provides long-term environmental protection by preventing the migration of hazardous constituents from the facility. Although some landfills in Canada have been "approved" to accept hazardous wastes, none currently accept PCB wastes.

Recovery of suitably decontaminated articles for scrap metal, such as transformers, hydraulic equipment and heat exchanger equipment, should be given first priority. Incineration should be given second priority. Landfilling should be used only as a last resort and only when the landfill has been approved for the designated waste.

7 EMERGENCY PREPAREDNESS AND PROCEDURES

7.1 General

Emergencies involving PCBs can occur with equipment in-service, in storage, during transport, or at a disposal facility. These emergencies may take the form of:

- a leak or spill of PCB liquid;
- the catastrophic failure of a piece of in-service equipment;
- the accidental breach of a container of PCBs; and
- fires.

Of these four emergency situations, fires involving PCBs may have the most serious consequences because they generate large quantities of oily soot which may be contaminated with PCBs, polychlorinated dibenzofurans (PCDFs) and polychlorinated dibenzo-ρ-dioxins (PCDDs). The latter are often referred to as "furans" and "dioxins". This soot could be extremely hazardous to human health and is very difficult to remove during clean-up (16). PCDFs originate from the combustion of PCBs, while PCDDs originate from the combustion of chlorobenzenes which are an askarel constituent.

The precautions outlined in the sections of this manual dealing with the design and operation of PCB storage and disposal facilities can help prevent most emergencies.

7.2 Emergency Preparedness through Emergency Planning

All companies operating storage or disposal facilities or transporting PCBs should develop and implement an emergency action plan. In some provinces, this is a requirement of the provincial ministry of environment. This plan should provide information on:

- emergency actions that should be taken in the event of a PCB spill or fire;
- personal protection equipment that should be used during an emergency response;
- corporate personnel who can be contacted on a 24-hour basis to supervise emergency actions; and
- regulatory notification requirements detailing who must be notified in the event of an emergency, both provincially and federally.

The degree of planning and preparation required for a specific emergency plan will vary with the quantity and concentrations of PCBs involved, e.g., a slightly contaminated mineral oil transformer located at an outdoor substation would require a

less sophisticated emergency plan than a similar transformer containing askarel located in a commercial or industrial building. All the elements of emergency planning should be considered and a degree of preparedness decided upon prior to any action being taken with respect to any PCB equipment or waste.

All personnel working with PCBs should become familiar with the contents of the emergency plan. It is recommended that employees be trained in use of the plan, preferably through emergency drills. As well, employees should be trained in the use of personal protection equipment, spill control kits, and fire extinguishers. They should also be made aware of the hazards of PCBs.

7.3 Emergency Procedures for PCB Spills

Spills of PCB liquid must be acted upon and clean-up operations commenced as soon as possible after detection. In an emergency or clean-up situation, an assessment should first be made of all possible hazards associated with the situation so that appropriate safety procedures and protective equipment may be used.

7.3.1 General Spill Clean-up Procedures. Spill clean-up procedures presented in this section address spills of PCB liquids such as askarel, decontamination flushings, and contaminated mineral oil. Spills of PCB-contaminated solid materials have less tendency to spread and are considerably easier to clean up than spills of liquids. Clean-up procedures for spills of PCB solids are discussed briefly at the end of this section. The special case of clean-up of spills of PCB-contaminated aqueous materials is presented in Section 7.4.

The following steps are recommended for the clean-up of PCB liquids:

- stop source of spill if possible;
- control further spread of the spill;
- notify authorized personnel of the spill and clean-up intentions;
- if workers or the public are at risk the provincial environment and health authorities as well as Environment Canada should be notified;
- consult with the provincial environment authority on the clean-up procedures;
- remove the PCBs from the surface where they have spilled; and
- obtain samples from the contaminated surface and test for the completeness of the clean-up.

Spread control: Immediate action should be taken to limit the spread of contamination by using dykes and drain plugs, as available, by removing articles that are not yet contaminated, and by any other action that can be readily undertaken.

Notification: Immediate notification of the appropriate authorities is required to ensure that they are informed about the PCB spill and that all clean-up resources are made available. For a spill on private property, authorized personnel identified in the facility's emergency plan should be contacted to respond to the spill emergency or give clean-up advice to on-site personnel. On-site personnel should assess the situation and contact other emergency agencies (fire or police) as warranted. The provincial environmental authority should be informed of all spills and the clean-up measures being taken. Environment Canada should also be contacted if information on emergency and spill clean-up procedures is needed. Transportation accidents involving PCB spills should be reported to local police and fire departments, and appropriate provincial/territorial authorities at the telephone numbers given on the TDG Waste Manifest.

Spill removal: PCB liquids should be removed from the contaminated area to as large an extent as possible using pumps and sorbent materials.

Sorbents: Some of the materials available in Canada and capable of absorbing PCBs and PCB-contaminated mineral oil are:

- sawdust
- vermiculite
- activated charcoal
- Oclansorb (Hi-Point Peat Ltd.)
- Imbiber beads (Dow Chemical Canada Inc., Sarnia)
- Hy-Dry (Tennier Absorbent Products Ltd., Hamilton)
- Diasorb (Diamond Shamrock Canada Inc., Cleveland)
- Stay-Dry (Waverly Mineral Products Co., Philadelphia)
- Oil-Dry (Waverly Mineral Products Co., Philadelphia)
- Conwed (C-I-L Inc.)
- 3-M matting (3M Canada Inc.)
- Graboil (R.B.H. Cybernetics (1970) Ltd.)

These materials all absorb PCBs to create a "quasi-solid" product that can be swept or shovelled into a container for disposal. Adequate supplies of sorbent material should be kept close to PCB equipment at all times. Other spill clean-up equipment including pumps and barrels should also be readily available.

Decontamination solvents: After the liquid PCBs have been removed through the use of sorbents or pumps, the affected surfaces must be thoroughly decontaminated.

Surfaces that do not absorb PCBs, such as steel or PCB-resistant concrete, should be decontaminated by thoroughly rinsing with a solvent, such as Varsol, turpentine, No. 1 fuel oil, or kerosene, until the PCBs are removed. PCB-contaminated solvents and cleaning rags should be disposed of as a PCB waste. Materials that absorb PCBs, such as wood, asphalt, concrete, soil and sediments, should be examined to determine the depth of PCB penetration. The contaminated surface layer should be decontaminated or physically removed to meet provincial requirements. The material removed should be dealt with as a PCB waste when it contains more than 50 ppm PCB. Less contaminated material should be handled and disposed in a manner acceptable to provincial authorities.

7.3.2 Specific Clean-up Procedures. As mentioned above, PCBs spilled onto concrete or into a containment system can be removed using pumps (if the liquid is pumpable) or sorbents. Spills onto soil or into water require more complex clean-up techniques.

Specific control actions for spills into containment systems, onto concrete or asphalt, soil, and into water, are given below (12). These control action plans are not intended to be all inclusive or to be applicable or adequate in all situations. For instance, to assess the threat to groundwater quality in the event of a large PCB spill on soil, provincial authorities may require extensive monitoring to determine the degree and extent of contamination and rate of migration. On the other hand, a small spill may not require such actions as building a dyke, taking core samples or pumping into drums. The purpose of the plans is to highlight the main actions that should be considered for spills in typical settings. Recommended national criteria are being developed for concentrations of PCBs in various media and will be published separately.

Spills into containment systems:

Notify authorized personnel and appropriate authorities of spill and clean-up intentions.

Take precautions to avoid personal contamination (see Section 7.3.3).

Pump PCB liquids into drums. If impossible to pump, soak up PCB liquids with sorbents such as those listed in Section 7.3.1.

Wipe area clean with rags and appropriate solvent, such as Varsol, turpentine, No. 1 fuel oil, or kerosene.

Dispose of all contaminated clean-up materials and waste PCB liquid.

Spills on concrete or asphalt:

Control the spread of the spill.
Notify authorized personnel and appropriate authorities of spill and clean-up intentions.
Take precautions to avoid personal contamination (see Section 7.3.3).
Plug or dyke all drains to sewers and ditches.
Soak up PCB liquids with sorbents of the type listed in Section 7.3.1.
Wipe area clean with rags and appropriate solvent, such as Varsol, turpentine, No. 1 fuel oil or kerosene.
Take core samples to determine penetration and need to excavate.
If necessary remove contaminated surface material and handle as PCB waste.
Dispose of contaminated materials and waste PCB liquid.

Spills on soil:

Control the spread of the spill by building dykes to contain the PCB liquids.
Notify authorized personnel and appropriate authorities of spill and clean-up intentions.
Take precautions to avoid personal contamination (see Section 7.3.3).
Pump PCB liquids to drums. If impossible to pump, soak up PCB liquids with sorbents such as those listed in Section 7.3.1.
Dispose of contaminated clean-up materials and waste PCB liquid.
Take core samples to determine penetration and need to excavate.
If necessary remove contaminated soil and handle as PCB waste.
If requested by the local regulatory authority monitor wells and other waters in proximity of spill for PCB contamination.

Spills into water bodies:

Notify authorized personnel, downstream water filtration plants, and appropriate authorities of spill and clean-up intentions.
Take precautions to avoid personal contamination (see Section 7.3.3).
Dam area if possible and close off to vessels in navigable waters.
Use dredges to collect contaminated sediment.
Dispose of contaminated materials as PCB waste.

PCB-solid spills:

Spills of PCB solids should be removed by shovelling or scooping the solid into drums, followed by wiping the contaminated area, where possible, with a solvent. The drummed solid waste and contaminated cleaning materials should be disposed of as PCB waste.

Spill control kit:

Equipment and materials for the clean-up of PCB spills, such as sorbents, pumps, solvents, cleaning rags, plugs for blocking drains, and portable dykes, should be stored together as a PCB "spill control kit" within easy access of a PCB storage area. All persons authorized to work in a PCB storage or disposal area should be familiar with the location of the "spill control kit" and be thoroughly trained in its use. They should also be familiar with methods of packaging and handling of PCB-contaminated waste generated in the clean-up.

7.3.3 Personal Safety Equipment and First Aid

Clean-up personnel should take care to avoid contact with PCBs and volatile cleaning solvents. Protective equipment, appropriate to the degree of hazard of a specific spill, should be worn at all times and must comply with the appropriate federal and provincial regulations. It is recommended that the following protective equipment and clothing be available, all of which should be made of PCB-resistant materials (see Table 1).

- disposable coveralls that completely cover arms and legs;
- gloves with high gauntlets that completely cover hands and wrists;
- boots and splash aprons;
- tight-fitting chemical resistant goggles or full face shield; and
- clothing of heat-resistant materials when working with hot liquids.

If exposure to hot PCB liquid (>55°C) or volatile cleaning solvents is anticipated for more than short intervals during clean-up, it is recommended that self-contained breathing apparatus be worn. References (5) and (6) provide guidance on protective clothing and equipment.

During spill clean-up, it is recommended that the clean-up area be well ventilated to minimize exposure to PCB vapour or volatile solvents. Clean-up personnel should take care to avoid splashing PCB liquids and should decontaminate or dispose of all

protective equipment and clothing that have been contaminated with PCBs. Workers should remove contaminated protective equipment before leaving the spill area in order to limit the spread of PCBs from the area.

If a person is exposed to PCBs during a clean-up or in any other situation, the first aid treatments shown in Table 4 should be followed.

TABLE 4 FIRST AID FOR EXPOSURE TO PCB LIQUIDS

Exposure Type	First Action	Second Action
PCB liquids on skin	Wash thoroughly with soap and water.	See physician if rash develops.
PCB liquid in eyes	Flush eyes with gentle stream of lukewarm water for 15 minutes keeping eyelids apart.*	See physician.
PCB/chlorobenzene liquids swallowed	Do not give victim anything to drink, rinse out mouth with water.	Write down details about the swallowed liquid and take victim to hospital emergency or physician immediately.
Strong PCB/ chlorobenzene fumes, e.g., vapour from PCBs and chlorobenzenes	Get victim into fresh air.	If discomfort does not clear up, take victim to physician.

* An on-site eye wash station should be provided where PCBs are handled frequently.

7.4 Emergency Procedures for Fires Involving PCBs

Although PCBs are classified as non-flammable liquids, they will burn at elevated temperatures. As a result, PCB liquids should be stored in isolation from other flammable materials (such as oils, coal, wood products and compressed gases). Fires involving PCBs are smoky and yield large amounts of black oily soot. This soot may be contaminated with PCBs, PCDFs and, if chlorobenzenes are present in the PCB fluid, PCDDs (17).

PCB fires are typically "small" and are easily extinguished with chemical foam, Halon, nitrogen flood, or carbon dioxide. Water should never be used as an extinguishing agent as contaminated water is very difficult to contain in an emergency

situation and could spread contamination. In the case of PCB fires in electrical equipment, always disconnect the equipment from its power source before attempting to extinguish the fire.

Because most of the contamination resulting from a fire involving PCBs is not from PCB liquid release, but from contaminated soot, the transport of soot during the fire must be minimized. This can be accomplished by:

- extinguishing the fire as soon as possible; and
- shutting down the ventilation system in the fire area.

The automatic ventilation shut-off, where available, should be triggered by the fire alarm system in the PCB location. Unnecessary personnel working in the area of a PCB fire should leave immediately. The local fire department and company PCB-response personnel should always be kept up-to-date on the location of PCB equipment and PCB storage on a particular property so that they are fully aware of the special hazards in the event of a fire.

Recommendations to prevent contamination by PCDFs in fires involving electrical equipment containing PCBs are given in an Environment Canada report (17).

Response to PCB fires falls into two distinct phases: (a) extinguishing the fire, and (b) clean-up of surfaces contaminated with PCB liquid and soot which may be contaminated with PCBs, PCDFs and PCDDs. PCB fires should be extinguished as soon as possible. Firemen should always be advised that they are dealing with a fire involving PCBs.

7.4.1 Protective Clothing. Firemen should ensure that all skin is covered to prevent exposure to smoke containing PCBs. The following protective clothing and equipment should be worn by all personnel entering the fire area:

- polyethylene/canvas jacket and pants,
- rubber boots,
- gauntlet gloves, and
- self-contained breathing apparatus such as that produced by Mine Safety Appliances Company or a Scott Airpak.

Protective clothing that cannot be decontaminated should be disposed of immediately after the fire, and all responding firemen should shower thoroughly to remove any soot that may have contacted uncovered skin. If a fireman develops a skin rash after the fire, he should go for a medical check-up.

7.4.2 Clean-up Procedures. Once the fire has been extinguished, the amount of surface contamination (PCBs, PCDFs, PCDDs) from the PCB soot should be determined and, if necessary, clean-up procedures undertaken. These procedures are similar to those recommended for surfaces contaminated with PCB liquid. A three-step procedure should be followed:

- first, remove soot immediately from surfaces with a high efficiency vacuum;
- wash surfaces next with an industrial strength anionic cleaner, such as Triton X-100 and water; and
- finally, wash surfaces with one of the decontamination solvents recommended in Section 7.3.1.

Care should be taken to prevent the release of PCBs, PCDFs and PCDDs to the environment. Contaminated soot, water and cleansers should be collected and disposed of as PCB waste. In large-scale clean-ups, PCB-contaminated water can also be treated for removal of PCBs by filtration through activated carbon filters (17) or reverse osmosis (18). The water should be continuously recycled until the PCB concentration meets provincial and municipal minimum requirements for release to the sewer system. Clean-up personnel should remove contaminated clothing, shower and then enter an uncontaminated "clean area" to change into street clothes. Air leaving the contaminated area should be exhausted through a high efficiency filtration system (17). Spent filters from air and water treatment systems should be handled as a PCB solid waste. This waste, along with discarded clothing and clean-up materials should be stored securely to await destruction by incineration.

Clean-up personnel should wear protective clothing and self-contained breathing apparatus at all times during the clean-up procedure. The protective clothing should be:

- light-weight because of the activity required in the clean-up process;
- PCB resistant; and
- either easy to decontaminate or discardable.

Fires involving PCBs should be reported to local and provincial environmental authorities as well as to Environment Canada, and these agencies should also be kept informed of the progress of the clean-up. Because of the special hazard and toxicity of PCDFs and PCDDs, surfaces must be decontaminated to extremely low levels of these contaminants. Clean-up personnel should consult the regulatory authorities identified

previously to determine the required level of decontamination and the testing methods required to determine it. Washing should be repeated until the surface contamination is reduced to the required level.

7.5 Emergency Response to a Transportation Accident

Spills or fires involving PCBs during transportation should be responded to in the manner described in Sections 7.3 and 7.4. During transportation, a spill control kit should be readily available. Personnel responsible for transport vehicles (conductors or drivers) should be thoroughly trained on what actions to take in the event of a PCB spill. The "Special Handling/Emergency Instruction" section of the manifest form should be read and understood by the conductor or driver before transportation commences.

In the event of an emergency involving a spill, the PCB leak should be contained inside the vehicle if possible. Plastic sheets should be placed under the vehicle to prevent PCB contamination of the ground underneath. The special actions spelled out in the manifest should be followed and the driver or conductor should then call the appropriate emergency telephone number given on the manifest.

REFERENCES

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APPENDIX A

SYNOPSIS OF CHLOROBIPHENYL REGULATIONS UNDER THE FEDERAL ENVIRONMENTAL CONTAMINANTS ACT

APPENDIX A - SYNOPSIS OF CHLOROBIPHENYL REGULATIONS UNDER THE ENVIRONMENTAL CONTAMINANTS ACT

1. Chlorobiphenyl Regulations No. 1, Amendment (effective July 1, 1980)

Prohibitions

a. Use of PCBs in the operation of any product, machinery or equipment other than electrical capacitors and electrical transformers and associated electrical equipment manufactured in or imported into Canada before July 1, 1980; heat transfer equipment, hydraulic equipment, electro-magnets, and vapour diffusions pumps that were designed to use PCBs and were in use in Canada before September 1, 1977; and machinery or equipment intended to destroy the chemical structure of PCBs.

b. Use of PCBs in the operation of electromagnets that are operated over food or animal feed or anything intended to be added to food or animal feed.

c. Use of PCBs as a constituent of any product, machinery or equipment manufactured in or imported into Canada after September 1, 1977, except for electrical capacitors and electrical transformers and associated electrical equipment.

d. Use of PCBs as a constituent of electrical capacitors and electrical transformers and associated electrical equipment manufactured in or imported into Canada after July 1, 1980.

e. Use of PCBs in the servicing or maintenance of any product, machinery or equipment, other than electromagnets and electrical transformers and associated electrical equipment.

f. Use of PCBs as new filling or as make-up fluid in the servicing or maintenance of any electromagnet, electrical transformer or associated electrical equipment.

Note: These regulations prohibit the importation of any product, machinery or equipment regardless of whether it was designed to use PCBs. In other words, these regulations prohibit the importation of mineral oil-filled transformers that are contaminated with PCBs.

2. Chlorobiphenyl Regulations No. 2 (Product)
(effective August 1, 1985)

Prohibitions

a. Importing, manufacturing or knowingly offering for sale any equipment listed in the regulation that is designed to use PCBs, and contains more than 50 parts per million of PCBs by weight.

Exemptions (allowed sales and import)

a. Sale of mineral oil transformers contaminated with PCBs. (Note: PCB filled transformers retrofilled with a non-PCB fluid may not be imported or sold if the PCB concentration is above 50 parts per million. Since these transformers were originally designed to use PCBs, the equipment would be subject to the prohibitions of Regulation No. 2).

b. Sale of PCB-filled equipment as a necessary and integral part of an immovable building, plant or structure that is offered for sale.

c. Sale of PCB-filled equipment for destruction or for storage awaiting destruction of the PCBs contained therein.

d. Importation of PCB-filled equipment for destruction of the PCBs contained therein. (This exemption is required in order to develop a reciprocal agreement between Canada and the U.S. for use of PCB-destruction facilities in either country once PCB destruction facilities are available in Canada).

3. Chlorobiphenyl Regulations No. 3 (Release)
(effective August 1, 1985)

Prohibitions

a. Willful release of PCBs in excess of 1 gram per day for any one piece or package of equipment listed in the regulation in the course of the operation, servicing, maintenance, decommissioning, transportation or storage of this equipment.

b. Willful release of PCBs from all other sources or activities in excess of 50 parts per million except for the application of PCBs to a road surface where the limit is 5 parts per million by weight.

Exemptions

a. The PCB Release Regulation does not apply in any water or place where subsection 33(2) of the Fisheries Act applies, i.e. waters frequented by fish or waters leading to fish-frequented waters. Places would include any industry or facility subject to regulations developed under subsection 33(2) of the Fisheries Act.

Subsection 33(2) of the Fisheries Act prohibits deposition of deleterious substances into fisheries waters except as may be permitted by regulations.

APPENDIX B

PCB WASTE TYPES

APPENDIX B - PCB WASTE TYPES

The following list of waste types and descriptions is provided to assist the reader in interpreting and applying the recommendations of this manual.

Askarel: Askarels are usually a mixture of PCBs and tri- and tetrachlorobenzene. In most equipment, this was the original PCB-containing fluid used. Typical transformer askarel will contain 65% PCB but it could also be in the 30-40% range. It will usually be a clear liquid with a density of the order of 1.5 kg/L. This waste is usually generated by draining equipment. Handling this waste separately, rather than mixing it with other waste streams, has the advantage of keeping the total mass of PCB waste to a minimum.

Concentrated Decontamination Flushings: These are usually the first flushings from decontamination of a transformer or from solvent washing of solid PCB waste. The PCB content is likely to be in the 1-10% range in solvents such as fuel oil, kerosene, trichloroethylene, Varsol, turpentine, or trichlorobenzene. The mixture could contain suspended solids but would generally behave as a liquid. Another process generating this waste would be the concentrated waste solvent from a rinse/soak process.

Decontamination Flushings: These wastes comprise solvents similar to those described above but with PCB concentrations less than 1%. These are generated in the later stages of equipment or solid waste decontamination, particularly from operations when only a few pieces of equipment are decontaminated and counter-current washing is not feasible. This category could also include solvent washings from lightly contaminated solids or solvent-washing extraction-liquor from the extraction of aqueous waste streams. These wastes will likely contain significant solids and may have an aqueous layer.

Contaminated Mineral Oil: Contaminated transformer mineral oil usually contains less than 1% PCBs. Mineral oil is used in most outdoor transformers and may have become contaminated by common industrial practices before the concern for PCBs was raised. The oil itself is generally a flammable liquid with a density somewhat below 1 kg/L; it usually does not contain significant amounts of suspended matter.

Contaminated Retrofilling Fluids: Retrofilling fluids are liquids used to replace PCBs in transformer applications (Table 2). Quite often, at some time subsequent to retrofilling, the new fluid becomes contaminated with residual amounts of PCB not removed by the original decontamination process.

PCB Transformers, Hydraulic Equipment, Electromagnets, Heat Transfer Equipment, Vapour Diffusion Pumps: These large pieces of electrical/mechanical equipment may be drained and/or decontaminated hulks or complete units still containing PCBs or PCB-contaminated fluids. At some point in the waste management process they will be drained and, depending upon the degree of contamination and the intended method of disposal, decontamination may or may not be required. Drained equipment that previously contained a liquid intended with <500 ppm of PCBs can be scrapped for metal recovery providing all appropriate federal and provincial regulations are observed.

Large PCB Capacitors: These are capacitors containing more than 0.5 kg of PCBs. The size will range from that of a small book to tall thin rectangular cans up to 1 m in height. The internals are paper and metal foil wound together, totally immersed and thoroughly impregnated with PCBs. Free PCB liquid that can be collected from an opened PCB capacitor will typically amount to about 50% of the total quantity of PCBs contained in the unit. PCB capacitors are shreddable.

Small PCB Capacitors: These are capacitors containing less than 0.5 kg of PCB. They may be associated with electronic or lighting equipment, and may be difficult (time consuming) to identify or separate from this equipment. While they will be difficult to identify individually, they may be collectable from a large number of similar units, e.g., lighting ballasts. Where possible they should be collected and treated as a PCB waste. Environment Canada has published a report on the procedures for identifying ballasts that contain PCBs (14).

Maintenance and Decommissioning Wastes: These wastes will be similar to industrial waste from maintenance operations, and will include small tools, rags, plastics, paper, sorbents, and some free liquid -- usually a cleaning solvent contaminated with PCBs. The PCB concentration will be highly variable.

Waste Oil: This would include used lubricating oils or other oils that have become contaminated with PCBs. Generally this waste will be a liquid but sludge may also be present.

Residues: These wastes may be ash from incineration, organic sludge from sodium-based oil-decontamination processes, or solids from the decontamination of solid wastes. These should be handled with care as they can be contaminated with PCBs. The disposal method will depend upon the degree of contamination of the residues.

Soils and Demolition Spoils: These are solid wastes resulting from a spill clean-up. These wastes could be building materials (wood, cement, paint, plastics, plaster, and metal) that have been contaminated as a result of a spill of PCBs. They could also contain sorbents, decontamination liquids, rags or paper.

Dredging Spoils: These are sediments from streams, urban drains, or marine dredging. Dredging spoils are similar to soil wastes except that water content is much higher and they may have to be handled as liquids. The PCB concentration can range up to thousands of parts per million, and may be largely associated with an organic component of the waste.

Aqueous Waste: Although solubility of PCBs in water is very low, aqueous waste from a variety of sources may be contaminated with PCBs that are associated with suspended matter. Some examples of aqueous waste are water from fire-fighting clean-up operations, groundwater at a spill site, and scrubber discharge from a PCB destruction incinerator.

APPENDIX C

INCINERATION REQUIREMENTS

APPENDIX C - INCINERATION REQUIREMENTS (Liquid Injection and Rotary Kiln)

1 Liquid Injection for PCB Liquids

An incinerator used for the destruction of PCB liquids shall satisfy the following requirements, which are intended to ensure a destruction efficiency of not less than 99.9999% on the basis of a PCB mass emission to air of 1 mg/L kg of PCB introduced into the unit.

a) Combustion criteria shall be either:

(i) maintenance of the introduced liquids for a 2-second dwell time at 1200°C (± 100°C) and 3% excess oxygen in the stack gas, or

(ii) maintenance of the introduced liquids for a 1.5-second dwell time at 1600°C (± 100°C) and 2% excess oxygen in the stack gas.

b) Combustion efficiency shall be at least 99.9%, as calculated by:

$$\text{Combustion efficiency} = \frac{CO_2}{CO + CO_2} \times 100\%$$

where: CO = concentration of carbon monoxide in the flue gas, and

CO_2 = concentration of carbon dioxide in the flue gas.

c) The rate and quantity of PCBs fed into the combustion system shall be measured and recorded at regular intervals of no longer than 15 minutes.

d) The temperatures of the incineration process shall be continuously measured and recorded.

e) The concentration of oxygen and carbon monoxide in the flue gas shall be continuously measured and recorded. The concentration of carbon dioxide shall be measured and recorded at a frequency to be specified by the appropriate authority.

f) Testing of the stack emission products for oxygen, carbon monoxide, carbon dioxide, oxides of nitrogen, hydrochloric acid, total chlorinated organics, PCBs, furans, dioxins, and particulate matter shall be conducted:

(i) when an incinerator is first used for the disposal of PCBs,

(ii) when the incinerator is first used for the disposal of PCBs after the incinerator or operating parameters have been modified in a manner which may affect the stack emissions, or

(iii) annually thereafter.

g) Automatic means shall be provided to prevent the burning of PCBs when the temperature or excess oxygen falls below the levels specified in Section 1a), monitoring operations fail, or the PCB feed-rate measuring and recording equipment fails.

h) Hydrogen chloride emissions from a PCB incinerator shall be controlled and shall meet the requirements specified by the appropriate authority.

i) Solid residues and liquid effluents from the incinerator should be tested on the same schedule as for stack emissions. These wastes will be disposed of according to the requirements specified by the appropriate authority.

2 Rotary Kiln for Non-liquid PCB Wastes

An incinerator used for the destruction of PCB wastes other than PCB liquids shall meet the following requirements:

a) The mass air emissions from the incinerator shall contain no greater than 1 mg PCBs/1 kg of PCBs introduced into the incinerator.

b) The incinerator shall comply with the provisions of 1 (b) through 1 (i) above.

APPENDIX D

HIGH EFFICIENCY BOILER REQUIREMENTS

APPENDIX D - HIGH EFFICIENCY BOILER REQUIREMENTS

PCB liquids may be co-fired in high efficiency boilers if they contain less than 500 ppm PCBs, provided that:

a) The boiler is rated at a minimum of 15 MJ/s.

b) For natural gas and oil-fired boilers, the carbon monoxide concentration in the stack gas is 50 ppm or less, and the excess oxygen is at least 3% when PCBs are burned.

c) For coal-fired boilers, the carbon monoxide concentration in the stack gas is 100 ppm or less, and the excess oxygen is at least 3% when PCBs are burned.

d) At any given time, the mass flow rate of the PCB liquid does not exceed 10% of the mass flow rate of the fuel.

e) PCB liquids are not fed into the boiler unless the boiler is operating at a minimum of 90% capacity.

f) The concentration of carbon monoxide and oxygen in the stack gas are measured and recorded continuously or at intervals of not longer than one hour if the boiler will burn less than 115 000 litres per year of PCB liquids.

g) The feed rates of the primary fuel and the PCB liquid, and the total quantity of primary fuel and PCB liquid, fed to the boiler are measured and recorded at intervals of not longer than 15 minutes.

h) The concentration of PCBs in each batch of waste is measured and recorded.

i) The flow of PCB liquid to the boiler shall stop automatically if the criteria noted in b) and c) above are not met, or if there is a failure in the monitoring equipment.

APPENDIX E

FEDERAL AND PROVINCIAL REGULATIONS RELATING TO PCBs

APPENDIX E - FEDERAL AND PROVINCIAL REGULATIONS RELATING TO PCBs

Jurisdiction	Legislation	Description
British Columbia	Waste Management Act, 1984	- Not specific to PCBs.
	Proposed Special Waste Regulations	- Proposed regulations would apply to PCBs in concentrations $\geq$ 50 ppm. - Regulations will require that permits be obtained for storage and disposal facilities, and that manifests be used for waste in transport. - Permits will include requirements and conditions for PCB storage and disposal.
Alberta	Hazardous Chemicals Act Regulations	- Licensing required for storage and disposal of PCBs. - 50 ppm is maximum concentration of PCBs for landfilling.
Saskatchewan	Municipal Drinking Water Objectives	- Not specific to PCBs. - PCBs should be undetectable (< 0.02 µg/L) in drinking water. - Maximum PCB concentration allowable for short-term (6 to 8 month maximum) release to drinking water is 3 µg/L.
	Environmental Spill Control Regulations	- Accidental releases of PCBs must be reported to the Spill Response and Control Section of Saskatchewan Environment. - Regulations require appropriate clean-up and disposal of spill-contaminated material.
	Environmental Protection Act	- Saskatchewan Environment must approve storage and disposal facilities.

APPENDIX E - FEDERAL AND PROVINCIAL REGULATIONS RELATING TO PCBs (Cont'd)

Jurisdiction	Legislation	Description
Manitoba	Dangerous Goods Handling and Transportation Act, August 1984	- Not specific to PCBs. - Requires licensing for handling, transport and disposal of PCBs; defines requirements for operation of a disposal facility. - Requires reporting of environmental accidents.
Ontario	Environmental Protection Act Waste Management - PCBs, Regulation 11/82 - January 1982 - Amendment 1984	- Controls handling, storage and ultimate disposal of PCB wastes. - Requires approvals for storage and disposal facilities; licensing includes specifications for operation, environmental controls and record-keeping in storage and disposal facilities. - Defines PCB wastes as wastes containing all PCBs at concentrations greater than 50 ppm.
	Mobile PCB Destruction Facilities Regulations O. Reg. 148/86 gazetted April, 1986	- Describes siting, operation, environmental control, monitoring, and bonding requirements for three types of mobile PCB destruction technologies: mobile incineration and mobile chemical destruction facilities. - Includes requirements for record keeping and record retention at disposal facilities. - Exempts mobile units on Crown or public lands from assessment.
	Origin and Management of PCB Wastes - April 1984	- Guidelines for handling, storage and disposal of PCB wastes.

APPENDIX E - FEDERAL AND PROVINCIAL REGULATIONS RELATING TO PCBs (Cont'd)

Jurisdiction	Legislation	Description
Ontario (continued)	Ontario Drinking Water Objectives - 1983	- Maximum allowable concentrations of PCBs in drinking water is 3 µg/L.
	Waste Management-General O. Reg. 309, November, 1985	- Controls movement, treatment and disposal of hazardous wastes, including PCBs.
Quebec	Environmental Quality Act	- Includes PCB requirements.
	Règlement sur les Déchets Dangereux	- Requires certificate of approval and operating permit for storage facilities. - Details proposed siting, operational (containment, waste mixing) and maximum storage time requirements for facilities storing hazardous wastes. - Requires operating permit for transportation of hazardous wastes. - Details transportation and waste handling requirements.
New Brunswick		- No specific PCB legislation.
	Clean Environment Act Reg. 82-126 - August 1982	- Requires certificate of approval for storage and disposal facilities.
Nova Scotia	Environmental Protection Act	- No specific PCB legislation. - Guideline for PCB concentration in drinking water is 3 ppb. - Acceptance of Environment Canada's 50 ppm guideline for PCB wastes.

APPENDIX E - FEDERAL AND PROVINCIAL REGULATIONS RELATING TO PCBs (Cont'd)

Jurisdiction	Legislation	Description
Nova Scotia (continued)		- Siting and operation of disposal facility would require certificate of approval and may require public hearings via Environmental Control Council.
Prince Edward Island		- No specific PCB or hazardous waste management legislation.
Newfoundland/Labrador		- No specific PCB legislation.
		- PCB waste controlled by Newfoundland Environment if concentration $\geq$50 ppm.
	Waste Material (Disposal) Act - 1973	- Requires licensing of storage facility if storage longer than six months.
		- Requires record keeping in storage and disposal facilities.
		- Requires licensing of disposal facilities.
Yukon Territories		- No specific PCB or hazardous waste management legislation.
Northwest Territory		- No specific PCB legislation.
	Commissioner's Land Act	- Requires licensing of waste disposal facilities.
	Environmental Protection Act	- Regulates waste and spill control and disposal of contaminants.
	Transportation of Dangerous Goods Act	- Adopts some of the federal transportation regulations.

APPENDIX E - FEDERAL AND PROVINCIAL REGULATIONS RELATING TO PCBs (Cont'd)

Jurisdiction	Legislation	Description
Canada	Environmental Contaminants Act Chlorobiphenyl Reg. No. 1	- Restricts the use and prohibits the importation, manufacture and processing of all PCBs with more than two chlorine atoms on the PCB molecule.
	Chlorobiphenyl Reg. No. 2 (Product)	- Prohibits importation, manufacture and sale of electric capacitors and transformers, electromagnets, heat exchangers, hydraulic equipment or vapour diffusion pumps, that are designed to use PCBs and contain more than "50 ppm PCB by weight".
	Chlorobiphenyl Reg. No. 3 (Release)	- Controls the maximum concentration of PCBs that can be willfully released to the environment in the course of a commercial, manufacturing or processing activity at: 50 ppm (general case); 5 ppm for road oiling; 1 g/day per piece or package of equipment.
	Fisheries Act	- Controls the release of deleterious substances to waterways frequented by fish.
	Transportation of Dangerous Goods Regulations - 1985	- Regulates the documentation, handling and control of dangerous goods for all interprovincial and international modes of transport. Through agreements with the federal government, provinces have jurisdiction for intraprovincial transportation of dangerous goods.
	Transportation of Dangerous Goods Act - Schedule No. 4, Amendment, May 28, 1986	- Regulates all road and rail PCB transportation activities and includes special exemptions for equipment in service and describes specific handling and packaging for PCBs.

APPENDIX F

ENVIRONMENT RESOURCE CONTACTS
PCBs AND HAZARDOUS WASTES
FEDERAL AND PROVINCIAL OFFICES

FEDERAL ENVIRONMENT CONTACTS FOR PCBs AND HAZARDOUS WASTES

Headquarters:

Officer, TDGA Program
Waste Management Division
Conservation and Protection
Environment Canada
Place Vincent Massey, 13th Floor
351 St. Joseph Boulevard
Hull, **Québec**
K1A 1C8
Telephone: (819) 997-3376
Telex: 053-4567

Compliance Officer
Regulations Development Division
Commercial Chemicals Branch
Conservation and Protection
Environment Canada
Place Vincent Massey, 14th Floor
351 St. Joseph Boulevard
Hull, **Québec**
K1A 1C8
Telephone: (819) 997-1476
Telex: 053-4567

Regional Offices

Contaminants Control Officer
Conservation and Protection
Environment Canada
Kapilano 100-Park Royal
3rd Floor
West Vancouver, **British Columbia**
V7T 1A2
Telephone: (604) 666-6711
Telex: 04-54476

Head, Environmental Quality Branch
Conservation and Protection
Environment Canada
Twin Atria No. 2, 2nd Floor
4999-98 Avenue
Edmonton, **Alberta**
T6B 2X3
Telephone: (403) 468-8020
Telex: 037-2099

Manager, Environmental Contaminants Branch
Conservation and Protection
Environment Canada
25 St. Clair Avenue East, 7th Floor
Toronto, **Ontario**
M4T 1M2
Telephone: (416) 973-1075
Telex: 062-3601

Project Engineer
Emergency and Wastes
Conservation and Protection
Environment Canada
1179 Bleury st.
Montréal, **Québec**
H3B 3H9
Téléphone: (514) 283-6418
Télex: 055-60234

Head, Hazardous Waste Section
Contaminants and Assessments Branch
Environmental Protection Service
Environment Canada
5th Floor, Queen Square
45 Alderney Drive
Dartmouth, **Nova Scotia**
B2Y 2N6
Telephone: (902) 426-6141
Telex: 019-21565

FEDERAL ENVIRONMENT CONTACTS (Continued)

District	Address	Telephone
Newfoundland	Conservation and Protection Environment Canada P.O. Box 5037, Building 310 Pleasantville St. John's, **Newfoundland** A1C 5V3	Office - (709)772-5488
Prince Edward Island	Conservation and Protection Environment Canada P.O. Box 1115 Charlottetown, **Prince Edward Island** C1A 7M8	Office - (902)892-7042
New Brunswick	Conservation and Protection Environment Canada P.O. Box 600 Fredericton, **New Brunswick**	Office - (506)452-3286
Ontario	Manager, National Capital Area Environment Canada Environmental Protection River Road Ottawa, **Ontario** K1A 1C8	Office - (613)991-1954
Manitoba	Conservation and Protection Environment Canada 800 Kensington Building 275 Portage Avenue Winnipeg, **Manitoba** R3B 2B3	Office - (204)949-4811
Saskatchewan	Conservation and Protection Environment Canada 2nd Floor 1901 Victoria Avenue Regina, **Saskatchewan** S4P 3R4	Office - (306)780-6464
Northwest Territories	Conservation and Protection Environment Canada P.O. Box 370 9th Floor, Bellanca Building Yellowknife, **Northwest Territories** X1A 2N3	Office - (403)873-3456

Yukon Territory	Conservation and Protection Environment Canada Room 225, Federal Building Whitehorse, **Yukon Territory** Y1A 2B5	Office - (403)667-7244*

* 24 hour service

PROVINCIAL ENVIRONMENT CONTACTS

Ministry of the Environment
Parliament Buildings
810 Blanshard Street
Victoria, **British Columbia**
V8V 1X5
Telephone: (604) 387-4321

Alberta Environment
Oxbridge Place
9820-106 th Street
Edmonton, **Alberta**
T5K 2J6
Telephone: (403) 427-5868

Saskatchewan Environment
Walter Scott Building
3085 Albert Street
Regina, **Saskatchewan**
S4S 0B1
Telephone: (306) 787-5811

Dangerous Goods Handling and
Transportation Information
Environmental Management Division
Department of Environment,
Workplace Safety & Health
Bldg. 2, 139 Tuxedo Avenue
P.O. Box 7
Winnipeg, **Manitoba**
R3N 0H6
Telephone: (204) 945-7094
Telex: 07-587589

Ontario Ministry of the Environment
40 St. Clair Avenue West, 5th Floor
Toronto, **Ontario**
M4V 1M2
Telephone: (416) 965-6191

Direction des Substances Dangereuses
Ministère de l'Environnement
3900, rue Marly
Ste-Foy, **Québec**
Boite Postale 34
G1Z 4E4
Téléphone: (418) 643-3794

Municipal Affairs and Environment
364 Argyle Street
P.O. Box 6000
Fredericton, **New Brunswick**
E3B 5H1
Telephone: (506) 453-2861
Telex: 014-46230

Department of the Environment
5151 Terminal Road
P.O. Box 2107
Halifax, **Nova Scotia**
B3J 3B7
Telephone: (902) 424-5300
Telex: 019-22734

Department of Community and
Cultural Affairs
3 Queen Street
P.O. Box 2000
Charlottetown, **Prince Edward Island**
C1A 7N8
Telephone: (902) 892-0311
Telex: 014-44154

Department of the Environment
Elizabeth Towers
100 Elizabeth Avenue
P.O. Box 4750
St. John's, **Newfoundland**
A1C 5T7
Telephone: (709) 576-2559
Telex: 016-4197

Pollution Control Engineer
Pollution Control Division
Department of Renewable Resources
Government of the Northwest
Territories
Yellowknife, **Northwest Territories**
X1A 2L9
Telephone: (403) 873-7654
Telex: 034-45528

Administrator, Transport Services
Department of Community and
Transportation Services
P.O. Box 2703
Whitehorse, **Yukon**
Y1A 2C6
Telephone: (403) 667-3032
Telex: 036-8260

APPENDIX G

TRANSPORTATION RESOURCE CONTACTS

FEDERAL AND PROVINCIAL TRANSPORT CONTACTS

FEDERAL TRANSPORT CONTACTS

Consignors, Manufacturers, Consignees, Warehousemen, Freight Forwarders, Brokers, etc.

Transport Dangerous Goods
Transport Canada
Place de Ville
Ottawa, **Ontario**
K1A 0N5
Telephone: (613) 992-4624
Telex: 053-3130

Regional Manager
Transport Dangerous Goods
Transport Canada
Suite 309
549 Columbia Street
New Westminster, **British Columbia**
V3L 1B3
Telephone: (604) 666-2955

Regional Manager
Transport Dangerous Goods
Transport Canada
101-22nd Street East
Room 604, Federal Building
Saskatoon, **Saskatchewan**
S7K 0E5
Telephone: (306) 975-5105

Regional Manager
Transport Dangerous Goods
Transport Canada
391 York Avenue
Winnipeg, **Manitoba**
R3C 0P4
Telephone: (204) 949-5969

Regional Manager
Transport Dangerous Goods
Transport Canada
Canada Centre
200 Town Centre Court
Scarborough, **Ontario**
M1P 4X8
Telephone: (416) 973-4599

Regional Manager
Transport Dangerous Goods
Transport Canada
1035 Galt St 2nd Floor
Verdun **(Quebec)**
H4G 2R1
Telephone: (514) 283-7369

Regional Manager
Transport Dangerous Goods
Transport Canada
5670 Spring Garden Road
Halifax, **Nova Scotia**
B3J 1H6
Telephone: (902) 426-6532

Railway Transport

Chief, Compliance and
Dangerous Goods Coordinator Eastern Canada
Operations Branch
Railway Transport Committee
Canadian Transport Commission
25 Eddy Street (Hull, Québec)
Ottawa, **Ontario**
K1A 0N9
Telephone: (819) 997-7077
Telex: 053-4254

Chief, Dangerous Commodities
Railway Transport Committee
Canadian Transport Commission
5th Floor, 65 Adelaide Street E.
Toronto, **Ontario**
M5C 1K6
Telephone: (416) 369-4820

FEDERAL TRANSPORT CONTACTS (Cont'd)

Railway Transport (Cont'd)

Dangerous Goods Coordinator-
Western Canada and Chief, Operations
Railway Transport Committee
Canadian Transport Commission
Suite 1740, Royal Centre
Vancouver, **British Columbia**
V6E 3P3
Telephone: (604) 666-0011

Chief, Facilities and Equipment Assessment
Railway Transport Committee
Canadian Transport Commission
Room 372
Government of Canada Bldg.
220-4th Avenue S.E.
P.O. Box 2917
Station "M"
Calgary, **Alberta**
T2P 3C3
Telephone: (403) 231-4811

Chief Evaluation of Equipment and Installations
Railway Transport Committee
Canadian Transport Commission
Quebec Region
685 Cathcart Street
Montreal, **Quebec**
H3B 1M7
Telephone: (514) 283-5722

Chief, Operations and Maintenance
Railway Transport Committee
Canadian Transport Commission
4th Floor, Terminal Plaza Bldg.
1222 Main Street
Moncton, **New Brunswick**
E1C 1H6
Telephone: (506) 388-7040

Chief, Equipment & Dangerous Commodities
Railway Transport Committee
Canadian Transport Commission
700-433 Main Street
Winnipeg, **Manitoba**
R3B 1B3
Telephone: (204) 949-4214

PROVINCIAL TRANSPORT CONTACTS

Road Transport

Director, Administration and Road Safety
Motor Vehicle Department
Ministry of Transportation and Highways
2631 Douglas Street
Victoria, **British Columbia**
V8T 5A3
Telephone: (604) 387-3142 or 387-5585
Telex: 049-7273

Executive Director
Dangerous Goods Control
Public Safety Services
No. 144, 14315 - 118 Avenue
Edmonton, **Alberta**
T5L 2M3
Telephone: (403) 422-1909
Telex: 037-43363

(Alberta will also do Consignors, Manufacturers, Consignees, etc.
(L'Alberta s'occupera également des expéditeurs, fabricants, destinataires, etc.)

Dangerous Goods Officer
Planning Support Branch
Transportation Planning and Research Division
Saskatchewan Highways and Transportation
1855 Victoria Avenue
Regina, **Saskatchewan**
S4P 3V5
Telephone: (306) 787-4780

Dangerous Goods Handling and Transportation Information
Environment Management Division
Department of Environment, Workplace Safety & Health
Bldg. 2, 139 Tuxedo Avenue
P.O. Box 7
Winnipeg, **Manitoba**
R3N 0H6
Telephone: (204) 945-7094
Telex: 07-587589

Co-ordinator
Dangerous Goods Project
Ontario Ministry of Transportation and Communications
Room 212, West Building
1201 Wilson Avenue
Downsview, **Ontario**
M3M 1J8
Telephone: (416) 248-7451
Telex: 065-24145

Direction du transport routier des marchandises
Ministère des Transports
700, est, St-Cyrille - 22e étage
Québec **(Québec)**
G1R 5H1
Téléphone: (418) 643-2235
Télex: 051-3733

Deputy Registrar of Motor Vehicles
Motor Vehicle Division
Department of Transportation
Kings Place, York Tower
York Street
P.O. Box 6000
Fredericton, **New Brunswick**
E3B 5H1
Telephone: (506) 453-2407
Telex: 041-46230

Supervisor or Director
Motor Vehicle Inspection Division
Road Transport Inspection Section
Department of Transportation
6061 Young Street
P.O. Box 156
Halifax, **Nova Scotia**
Telephone: (902) 424-4335
Telex: 019-2286

Highway Equipment Manager
Department of Transportation
P.O. Box 4750
St. John's, **Newfoundland**
A1C 5T7
Telephone: (709) 576-3808
Telex: 016-3101

Director
Highway Safety Division
Transportation and Public Works
17 Haviland Street
P.O. Box 2000
Charlottetown, **Prince Edward Island**
C1A 7N8
Telephone: (902) 892-5306
Telex: 014-44154

Pollution Control Engineer
Pollution Control Division
Department of Renewable Resources
Government of the Northwest Territories
Yellowknife, **Northwest Territories**
X1A 2L9
Telephone: (403) 873-7178
Tele: 034-45528

Administrator, Transport Services
Department of Community & Transportation Services
P.O. Box 2703
Whitehorse, **Yukon**
Y1A 2C6
Telephone: (403) 667-5832
Telex: 036-8-260